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OHIO RIVER POLLUTION SURVEY. VOLUME II. MAJOR TRIBUTARY BASINS

Public Health Service
Cincinnati, Ohio

1942

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OHIO RIVER POLLUTION SURVEY

FINAL REPORT
TO THE
OHIO RIVER COMMITTEE

VOLUME II
(OF THREE VOLUMES)

1798

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CINCINNATI, OHIO
1942

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CINCINNATI, OHIO
1942

OHIO RIVER POLLUTION SURVEY

FINAL REPORT
TO THE
OHIO RIVER COMMITTEE

VOLUME II

(Of Three Volumes)

MAJOR TRIBUTARY BASINS

ALLEGHENY
BEAVER
HOCKING
LITTLE KANAWHA
MONONGAHELA
MUSKINGUM
KANAWHA
BIG SANDY
GUYANDOT

1798

Prepared at the request of the War Department by the U. S. Public Health Service in cooperation with the Corps of Engineers, U. S. Army.

FINAL REPORT - OHIO RIVER POLLUTION SURVEY

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INTRODUCTION TO DRAINAGE BASIN SUMMARIES

The basic information of the Ohio River Pollution Survey has been presented in summaries covering the main Ohio River, minor tributary basins and the nineteen major tributary basins. An effort has been made to have each summary complete in itself. Certain explanations, applicable to each, have been made in this section to avoid repetition.

Insofar as possible, information for each basin is preseted in as near identical form as possible, according to the following general outline:

Syllabus and Conclusions
Description
Presentation of Field Data
Presentation of Laboratory Data
Hydrometric Data
Discussion

Accompanying the text are a number of tables, maps and charts. With the exception of the division on the main Ohio River, similarly numbered tables and figures cover similar material in each basin summary.

In the tabulations of costs (Table 1) the annual charges are based on interest rates of 3½% for municipal and 5% for industrial construction and periods for amortizations of 40 years for interceptors, 20 years for municipal treatment plants and 10 years or less for industrial corrective measures. Studies of interest rates and life of treatment facilities have indicated that these figures represent about the average experience of municipalities and industries. Cost estimates of individual projects are not shown except in a few cases where they are based on engineering surveys. Since most of the estimates are not based on detailed studies of each situation they may be considerably in error in individual instances. Grouped for an entire basin, the probability of error is greatly reduced and it is believed that the figures shown are an accurate indication of the cost of the suggested pollution abatement program. Costs of providing lateral sewers or for the extension of sewers to areas now lacking them are not included in the estimates.

The urgency of the individual projects for which cost estimates have been made is far from uniform. Some projects are needed to correct critical pollution conditions while in other cases the need and justification for the expenditure is less outstanding. The basin summaries place stress on the more critical and larger sources of pollution where effects are not confined to local areas. However, cost estimates presented apply not only to the urgent situations but to a complete program of pollution control such as might take place during the course of the next 10 to 20 years. In the special case of a stream highly acid from the effects of mine drainage, expenditure of public funds for acid reducing measures should precede or at least parallel expenditures for sewage and organic pollution abatement.

Cost estimates are based on average experience from 1928 to 1940. Costs for 1942 would be considerably higher and future costs will probably be subject to further change depending upon fluctuation in construction costs for this type of work.

Throughout the report quantities of organic industrial wastes have been expressed as "sewered population equivalent (B.O.D.)".* Extensive measurements have shown that the average oxygen demand of domestic sewage is .168 pound (5-day,20°C.) per capita per day and this factor has been used to convert industrial waste loads to a readily understandable basis. In the tabulations of sources of pollution (Table 3), the column "Sewered Population Equivalent (B.O.D.), Untreated" represents the total of the population connected to sewers plus the population equivalent of industrial wastes discharged at each locality. The difference between this column and the adjacent column "Sewered Population Equivalent (B.O.D.), Discharged" represents the reduction in the pollution load due to treatment in a municipal treatment plant.

Where accurate laboratory results of treatment plant operation were available, these were used to determine the pollution load both before and after treatment. In the absence of such records reductions of 35% by primary treatment and 85% by secondary treatment were assumed.

No differentiation has been made in the tables, maps or charts between industrial wastes which are discharged only seasonally and those which are discharged throughout the year. The pollution loading shown represents conditions during normal operations at the height of the season. In the case of the canning industry, this may occur only during a few weeks in the year but these few weeks are often during the late summer when the effects of organic pollution on the oxygen balance of the stream are most serious. On the other hand, the season for distillery operations in most cases is during the winter months when the effects of oxygen depleting pollution are less serious.

---

* Biochemical Oxygen Demand (5-day 20° C.).

Nowhere in the report has a quantitative statement been made as to the reduction in the industrial waste pollution load due to treatment, recovery, or other measures at the industrial plant. Such a statement would necessitate a definition of the strength of untreated industrial wastes from each type of industry. This is impracticable since the strength of the wastes depends to a large degree on plant practices which vary widely. For instance, in some meat packing plants all blood, paunch manure and offal are recovered and in others these materials are discharged to the plant sewers. Wastes discharged from vegetable canneries have been found to vary by as much as 400% due to differences in "housekeeping" methods. Wastes from paper mills vary depending on the use of save-alls, recirculating systems and other pollution reduction measures. At some plants reduction in pollution is inadvertent and is brought about by the recovery of valuable by-products or prevention of waste of raw materials. At others expense is incurred which produces nothing but a reduction in pollution discharges. Tabulations of industrial wastes (Table 4) shows the number of plants that have taken steps of either kind which result in some reduction in the pollution load from the plant.

ALLEGHENY RIVER BASIN

Final Report to the Ohio River Committee

Ohio River Pollution Survey

U. S. Public Health Service
Cincinnati, Ohio
1942

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ALLEGHENY RIVER BASIN

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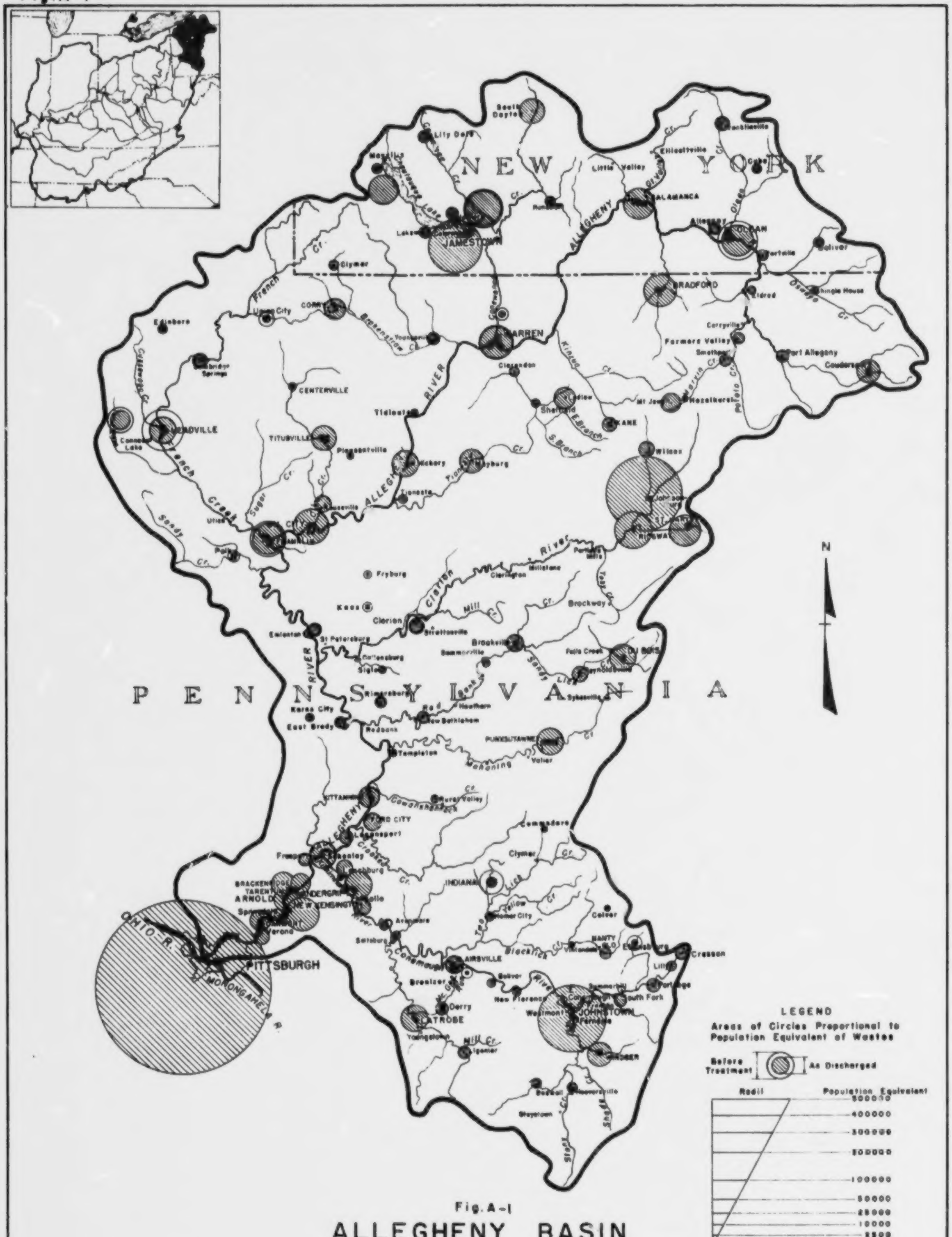

NEW YORK
PENNSYLVANIA
JAMESTOWN
SALAMANCA
OLEAN
BRADFORD
WARREN
MEADVILLE
TITUSVILLE
CENTERVILLE
KANE
Clarion
Brookville
DU BOIS
PUNXSUTAWNEY
KITTANNING
INDIANA
ARNOLD
NEW KENSINGTON
PITTSBURGH
BLAIRSVILLE
LATROBE
JOHNSTOWN
WINDBER
ALLEGHENY RIVER
OHIO R.
MONONGAHELA R.
French Cr.
Clarion River
Mahoning Cr.
Conemaugh River
N
LEGEND
Areas of Circles Proportional to Population Equivalent of Wastes
Before Treatment
As Discharged
Radii
Population Equivalent
500000
400000
300000
200000
100000
50000
25000
10000
5000
800

Fig. A-1

ALLEGHENY BASIN

SOURCES OF POLLUTION

10 0 10 20
SCALE OF MILES

OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941

ALLEGHENY RIVER BASIN

Syllabus and Conclusions

Syllabus

The Allegheny River drains 11,730 square miles in western Pennsylvania and New York and joins the Monongahela River at Pittsburgh to form the Ohio River. The southern part of the basin is an important coal mining area and the streams there are polluted by acid mine drainage. The Kiskiminetas is the most strongly acid large stream in the Ohio Basin. A major portion of the sewage and industrial wastes in the basin enters the Allegheny in the vicinity of Pittsburgh. The Clarion River is grossly polluted by industrial wastes and greatly improved treatment techniques will be required to abate the pollution. The larger communities depend generally on surface water for municipal supplies and a number of these, particularly in the vicinity of Pittsburgh, are seriously affected by acid mine drainage, untreated sewage and industrial wastes. Considerable progress has been made toward pollution abatement in streams not subject to acid pollution and, in general, these streams are relatively clean.

A program of municipal and industrial waste treatment is outlined which, together with a basin-wide program of mine sealing supplemented by low-flow regulation incidental to flood control operations at reservoirs already built or authorized by the Congress, seems to offer the most practicable method of pollution abatement.

Conclusions

(1) Of 225 public water supplies, 91, including those serving most of the larger communities, are from surface sources.

(2) Sewage from about 920,000 people, industrial wastes equivalent in oxygen demand to sewage from an additional 680,000 people, and about 375,000 tons of mine acid per year enter the streams of the basin. About 18 percent of the sewage is treated.

(3) Laboratory data indicate that the major pollution problems are due to acid rather than to organic wastes although organic wastes cause gross pollution in a number of streams not affected by acid.

(4) Mine sealing has reduced the original acid load by about eight percent from 405,000 to 375,000 tons (to phenolphthalein - hot) per year and although the present load throughout the Allegheny Basin is only about 32 tons per square mile per year, the tributary Kiskiminetas Basin receives 164 tons of acid per square mile per year, or an intensity greater than the Monongahela or Youghiogheny, the next most strongly acid streams.

(5) A program for acid control including mine sealing supplemented by flow regulation is outlined in the section of the report on Acid Mine Drainage. Expenditures to date for mine sealing in the basin are estimated at $510,000. The next step in the mine sealing program is completion of sealing of mining areas not connected to active ventilation systems at mines where sealing costs will not exceed $10.00 per ton of acid sealed per year. The total estimated cost of this program in the Allegheny River Basin is $1,460,000.

(6) Acid conditions can be further improved and mine sealing supplemented by flow regulation from storage of a least 210,000 acre-feet in the Allegheny River Basin. This storage could be provided incidental to or in conjunction with flood control in reservoirs already built or authorized by the Congress.

(7) The problem of municipal sewage treatment at Pittsburgh is discussed in the section of the report on the main Ohio River. Low-flow regulation from reservoirs in the Allegheny River Basin will be of value in reducing treatment costs, notably at Pittsburgh and Cincinnati.

(8) Primary sewage treatment should be adequate at cities on the Allegheny River with the exception of Olean, New York (which now has primary treatment) and Coudersport, Pennsylvania. Effluents from existing and suggested plants near water intakes, notably those on the lower 30 miles of the Allegheny, should be chlorinated to reduce bacterial loadings on the water plants.

(9) Justification for treatment and the degree of treatment of sewage and organic industrial wastes in many cases is dependent upon the status of mine acid reduction measures. The situation varies with the degree of acidity of the stream and the amount of organic pollution discharged. At some places the need for waste treatment is urgent at present and at others the first expenditures of public funds can be made to best advantage toward furthering the acid reduction program. In general, cost estimates presented apply to a comprehensive program that will be justified in parallel with extensive acid control measures.

(10) Secondary treatment is indicated at six communities in addition to Coudersport, the largest ones being Bradford and DuBois. All of these communities are located on alkaline streams subject to extremely low flows.

(11) Additions or improvements to existing sewage treatment plants are indicated at seven places, the largest ones being Jamestown and Olean, New York. At Jamestown the necessary degree of treatment depends to some extent on the method of operation of the dam at the outlet at Lake Chautauqua.

(12) Industrial waste pollution is particularly severe along the Clarion River. Any major improvement in conditions there will require the development of better waste treatment techniques if plant operations continue at the present level.

(13) Cost estimates of a suggested program of sewage and industrial waste treatment are summarized from Table A-1 as follows:

Treatment	Capital Cost	Annual Cost
Existing	$ 5,460,000	$ 410,000
Suggested Additional	10,680,000	1,155,000

Estimated additional costs, over existing charges, of programs involving uniform treatment throughout the basin are:

Primary, all places	10,010,000	1,065,000
Secondary, all places	13,880,000	1,545,000

Table A-1 Allegheny River Basin - Estimated Cost of Existing and Suggested Minimum Corrective Measures for Sewage and Industrial Wastes, with Comparative Costs for Primary and Secondary Treatment.

	Number of Plants		Population Connected to Sewers	Capital Investment (Dollars)	Annual Charges (Dollars)		
	Prim.	Sec.			Amort. & Interest	Operation & Main.	Total
Existing Sewage Treatment	22	19	164,300	5,460,000	310,000	100,000	410,000
Suggested Minimum Correction							
Sewage Treatment Plants	86	7	712,200	6,350,000	450,000	305,000	755,000
Required Interceptors			-	3,670,000	170,000	-	170,000
Independent Industrial Waste Correction				660,000	90,000	140,000	230,000
Total				10,680,000	710,000	445,000	1,155,000
Comparative Cost							
Primary Treatment All Waste				10,010,000	660,000	405,000	1,065,000
Secondary Treatment All Waste				13,880,000	930,000	615,000	1,545,000
As Suggested				10,680,000	710,000	445,000	1,155,000

NOTE: Costs shown above do not include the cost of interceptors or treatment works for the city of Pittsburgh or its suburbs whose wastes would probably be treated at a plant along the Ohio River.

Description

The Allegheny River drains 11,730 square miles, of which 9,775 are in western Pennsylvania and 1,955 are in southwestern New York. The area is, for the most part, hilly or mountainous with steep slopes rising several hundred feet above the narrow stream valleys. In the northern and western portions of the basin, which have been glaciated, the topography is less rugged. The main stream rises in Potter County, Pennsylvania and flows in a northwesterly direction into New York where, after flowing west for about 30 miles, it turns southwest and flows back into Pennsylvania. The Allegheny River, about 325 miles long, joins the Monongahela River at Pittsburgh, Pennsylvania, to form the Ohio River.

The principal tributaries of the Allegheny River are:

Tributary Stream	Miles above Mouth	Drainage Area (Square Miles)
Kiskiminetas River	30.2	1,892
Mahoning Creek	56.2	417
Red Bank Creek	64.9	586
Clarion River	86.1	1,232
French Creek	126.6	1,246
Oil Creek	134.1	340
Tionesta Creek	154.2	485
Conewango Creek	192.0	898

The Kiskiminetas Basin is an important bituminous coal mining area and smaller amounts are mined in the Crooked Creek, Cowanshannock Creek, Mahoning Creek, Red Bank Creek and Clarion River Basins. Although coal underlies much of the area farther north, it is not of great economic importance. Oil is found in the northern part of the basin. Production in the Oil Creek area, the first developed oil field in the country, is decreasing and most of the oil comes from the newer fields to the east. Although almost all of the virgin forests which originally covered about 90 percent of the basin are gone, a large part of the basin is covered with second growth timber. The more level lands in the glaciated portion of the basin support a stable and prosperous agriculture.

The steel industry in the basin is concentrated around Pittsburgh and at Johnstown, which is also the center of the coal producing area of the Kiskiminetas Basin. The greatest concentrations of population are at these two places. The populations of the basin and its larger cities, excluding the city of Pittsburgh, are shown below:

	Populations			
Principal Cities	1910	1920	1930	1940
Johnstown, Pa.	55,482	67,327	66,993	66,668
Jamestown, N.Y.	31,297	38,917	45,155	42,638
New Kensington, Pa.	7,707	11,987	16,762	24,055
Olean, N.Y.	14,743	20,506	21,790	21,506
Oil City, Pa.	15,657	21,274	22,075	20,379
Meadville, Pa.	12,780	14,568	16,698	18,919
Bradford, Pa.	14,544	15,525	19,306	17,691
Entire Basin				
Rural	654,456	659,607	666,109	713,148
Urban	365,270	471,689	527,388	523,546
Total	1,019,726	1,131,296	1,193,497	1,236,694

Water Uses - The lower 70 miles of the Allegheny River have been improved for navigation by eight low-lift locks and dams which with backwater from the Emsworth Dam on the Ohio River, provide a navigable depth of nine feet. A considerable amount of coal, coke, sand, gravel and limestone moves on this waterway. One hydroelectric project has been built by private interests, the Piney project, on the Clarion River.

Construction of four flood-control reservoirs has been virtually completed by the Corps of Engineers. These are on Tionesta Creek, Mahoning Creek, Crooked Creek and Loyalhanna Creek and are part of a system of reservoirs on the Allegheny and Monongahela River and their tributaries intended primarily for the protection of the Pittsburgh metropolitan area. In addition to serving this purpose, it would be physically possible to utilize a portion of their capacity to increase stream flow in the Allegheny and in the tributary streams below the reservoirs during low-flow periods. Four additional reservoirs have been authorized by the Congress for flood control. The largest one would be on the Allegheny River above Warren, Pennsylvania, and has been planned to include storage for low-flow regulation.

The cleaner streams in the rather sparsely populated mountainous section north of the mining area are used extensively for recreation. A considerable part of the land in this section is in State Forests. Chautauqua Lake, Conneaut Lake and other smaller lakes in the basin also are widely used for recreation.

Presentation of Field Data

Figure A-1 shows the location and magnitude of the more important sources of pollution in the basin. Figure A-2 shows similar data and, in addition, the location of water supply intakes from polluted streams and laboratory data on coliform organisms, dissolved oxygen and B.O.D.

Public Water Supplies - Of the 225 public water supplies in the Allegheny River Basin, which serve about 1,545,000 people,* 91 are from surface sources. Only 21 of these are from polluted streams, the other 70 being from impounding reservoirs or small streams draining rural areas, but the 21 supplies include most of the largest ones. Table A-2 shows data on the surface water supplies of the basin.

The chemical quality of surface waters in this area is generally excellent except as it is modified by mine drainage, brines or other pollutants. The alkalinity and hardness are low, particularly in the mountainous area. In the glaciated portion of the basin the water is somewhat harder and more alkaline and the taste, odor and color troubles are often experienced due to algae growths and decomposition of organic matter in the numerous swamp areas and lakes. The alkalinity of the streams in this area, while considerably higher than Monongahela basin upland streams, is still quite low and makes the effects of acid mine drainage more serious than in other streams such as the Muskingum, Kentucky and Big Sandy where alkalinities are higher.

Sewerage - About 920,000 people in the basin are served by sewers. Only about 18 percent of the sewage is treated. Table A-3 shows data on sources of pollution and sewage treatment. More than half of the sewage is discharged untreated to the lower Allegheny in the vicinity of Pittsburgh and the Conemaugh and its tributaries in the vicinity of Johnstown, Pennsylvania.

Industrial Wastes - Table A-4 summarizes data on sources of industrial wastes by type of industry and method of disposal. These wastes are equivalent in oxygen demand to sewage from about 680,000 people. A small amount of industrial waste is treated in municipal plants.

No single industry is responsible for a major part of this pollution. Textile, pulp and paper, meat, by-product coke plants, tanneries, canneries and breweries all are large contributors to the industrial waste load. About 40 percent of the wastes are discharged to the Allegheny in the 30-mile stretch below the mouth of the Kiskiminetas. The by-product coke plants are at Johnstown, much of the textile industry is around Jamestown, oil refineries are scattered but the greater number are around Oil Creek. The upper Clarion River and its tributaries receive a large part of the pulp, paper and tannery wastes.

---

* Includes entire population served by Pittsburgh municipal supply and Pennsylvania Water Company, taken from Allegheny River. Part of population served is in Monongahela Basin and along the Ohio River.

The significance of the steel industry as a source of pollution is due almost entirely to the discharge of spent acids, acid salts, and rinse waters from pickling operations. About 27,000 pounds of free acid per day are discharged by steel mills in the basin. These mills are located along the lower Allegheny and Kiskiminetas Rivers. The acids from pickling operations represent only a small portion of the total acid load including that from mine drainage which affects these streams.

Acid Mine Drainage - The Kiskiminetas River is the most heavily acid large stream in the Ohio Basin. Smaller amounts of mine drainage enter other tributaries of the Allegheny River north of the Kiskiminetas. The estimated acid load in the Allegheny River basin, as presented in the section of the Ohio River Pollution Survey report on Acid Mine Drainage, is shown below:

Drainage Basin	Allegheny River except Kiskiminetas	Kiskiminetas River	Total Allegheny River
	Acidity in Tons per Year (to Phenolphthalein - Hot)		
Original Acid Load:			
Active Mines	26,457	223,896	250,353
Marginal Mines	6,760	23,805	30,565
Abandoned Mines	50,244	73,988	124,232
Total	83,461	321,689	405,150
Per Square Mile	8.5	170.0	34.5
Sealed Mines	24,040	20,270	44,310
Removed by Sealing	18,750	10,954	29,704
Present Load	64,711	310,735	375,446
Per Square Mile	6.6	164.2	32.0
Additional Removal (1)	32,330	132,630	164,960
Future Residual (2)	32,381	178,105	210,486
Per Square Mile	3.3	94.1	17.9

(1) Economical to remove in addition by sealing under 1940 restrictions with a cost limitation of $10.00 per ton of acid per year and sealing only in areas not connected to active ventilation systems.

(2) Capable of further reduction (possibly and additional 50 percent) by extended program.

Table A-2 Allegheny River Basin - Surface Water Supplies

Supply	Source	Mile (1)	Treatment (2)	Population Served (4)	Cons. M.G.D.
Supplies Below Community Sewer Outfalls					
Pennsylvania					
Pittsburgh	Allegheny River	8.0	FD (3)	(4)600,000	80.30
Penn. Water Co.	" "	8.5	FD	(4)167,200	11.00
Fox Chapel	" "	10.0	FD	3,500	0.14
Oakmont	" "	12.8	FD	14,500	2.50
New Kensington	" "	21.0	FD	35,000	3.60
Tarentum	" "	21.7	LD	13,000	0.90
Brackenridge	" "	22.5	FD	6,300	0.80
Natrona	" "	24.6	FD	12,000	0.47
Freeport	" "	29.3	FD	3,300	0.35
Cadogan	" "	38.5	FD	700	0.04
Kittanning	" "	45.6	FD	7,500	1.25
Furnace Run #1	" "	46.5	FD	600	0.02
Parker City	" "	84.0	FD	900	0.08
Emlenton	" "	91.6	FD	1,000	0.07
Saltsburg	Conemaugh River	57.5	LD	1,000	0.10
Indiana	Two Lick Cr.-Ramsey Run-Wells	93.0	FD	10,000	0.65
Hooversville	Stony Creek-Impounded	131.	LD	1,400	0.03
New Bethlehem	Red Bank Creek	88.5	FD	2,000	0.20
Franklin	French Creek-Wells-Spring	128.5	FD	14,000	2.20
Cambridge Spgs.	French Creek	174.	FD	2,200	0.40
New York					
Olean	Olean Creek	260.	FD	24,000	2.50
Total - Below Sewer Outfalls				920,100	107.60
70 Other Surface Supplies				345,400	31.78
Total - Surface Water Supplies				1,265,500	139.38

(1) Miles above mouth of Allegheny River.
(2) F - Coagulated, settled, filtered; L - Lime-soda softened; D - Chlorinated.
(3) Slow sand filters.
(4) Part of population served is outside Allegheny River Basin.

Table A-3 Allegheny River Basin - Sources of Significant Pollution Including Industrial Wastes Expressed as Sewered Population Equivalent (B.O.D.).

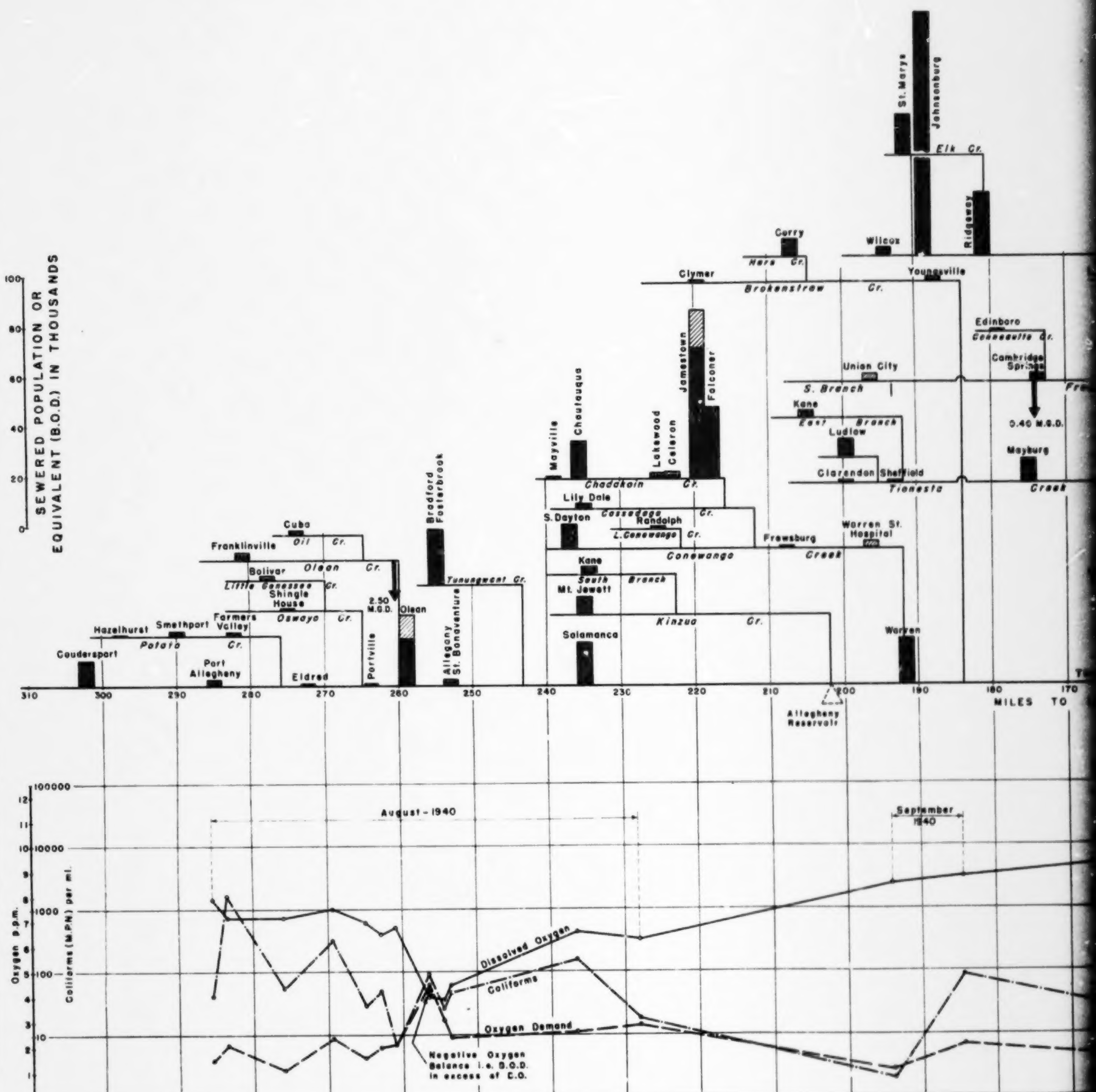
Municipality	State	Receiving Stream	Miles Above Mouth of Allegheny	Population Connected to Sewers	Sewage Treatment	Sewered Population Equivalent (BOD)	
						Untreated	Discharged
Pittsburgh and Suburbs (3)	Pa.	Allegheny River	0 to 8	320,500	None	597,200	597,200
Verona	"	" "	11	3,500	"	3,500	3,500
Oakmont	"	" "	12	6,200	"	7,400	7,400
Springdale	"	" "	17	5,000	"	5,000	5,000
Arnold	"	" "	19	10,900	"	10,900	10,900
New Kensington	"	" "	20	20,700	"	21,100	21,100
Tarentum	"	" "	22	16,300	"	17,500	17,500
Brackenridge	"	" "	22	6,900	"	6,900	6,900
Natrona	"	" "	23	5,000	"	5,000	5,000
Freeport	"	" "	29	2,700	"	2,700	2,700
Shenley	"	" "	30	-	-	14,000	14,000
Loganeport	"	" "	38	-	-	2,800	2,800
Ford City	"	" "	42	5,900	None	5,900	5,900
Kittanning	"	" "	46	7,500	"	7,500	7,500
Franklin	"	" "	125	13,000	Primary	24,000	19,500
Oil City	"	" "	134	20,000	None	21,400	21,400
West Hickory	"	" "	161	-	-	12,000	12,000
Warren	"	" "	192	15,000	None	18,400	18,400
Salamanca	N.Y.	" "	235	9,500	"	17,000	17,000
Olean	"	" "	259	24,000	Primary	28,500	19,000
Port Allegheny	Pa.	" "	285	2,300	None	2,600	2,600
Coudersport	"	" "	302	2,200	"	5,800	5,800
Leechburg	"	Kiskiminetas R.	35	4,300	"	4,300	4,300
Vandergrift	"	" "	40	11,400	"	11,400	11,400
Apollo	"	" "	44	3,200	"	3,200	3,200
Latrobe	"	Loyalhanna Cr.	80	8,400	"	12,700	12,700
Blairsville	"	Conemaugh River	77	5,000	"	5,000	5,000
Johnstown and Suburbs	"	" "	109	70,700	"	160,600	160,600
Derry	"	McGee Run	85	3,000	Sec. (1)	3,000	3,000
Westmont	"	Stony Creek	110	4,200	None	4,200	4,200
Ferndale	"	" "	115	2,700	"	2,700	2,700
Windber-Paint	"	Paint Creek	122	10,700	"	10,700	10,700
East Conemaugh	"	L.Conemaugh R.	112	4,800	"	4,800	4,800
Portage	"	" " "	130	3,000	"	3,100	3,100
Cresson	"	" " "	140	2,500	"	2,500	2,500
Punxsutawny	"	Mahoning Creek	110	8,600	"	13,800	13,800
Brookville	"	Red Bank Creek	113	4,300	"	4,400	4,400
Reynoldsville	"	Sandy Lick Cr.	130	3,600	"	3,600	3,600
DuBois	"	" " "	146	12,000	"	13,800	13,800
Ridgway	"	Clarion River	181	6,300	"	25,300	25,300
Johnsonburg	"	" "	189	4,600	"	96,600	96,600
St. Marys	"	Elk Creek	191	7,800	"	16,000	16,000
Wilcox	"	W.Br.Clarion R.	194	-	-	3,500	3,500
Meadville	"	French Creek	156	20,000	Secondary	29,800	12,800
Cambridge Springs	"	" "	174	2,200	Primary	3,300	2,500
Rouseville	"	Oil Creek	138	1,000	None	5,800	5,800
Titusville	"	" "	150	8,100	"	11,100	11,100
Mayburg	"	Tionesta Creek	175	-	-	9,600	9,600
Kane	"	E.Br.Tionesta Cr.-Hubert Run	210	6,300	None	6,300	6,300
Ludlow	"	Two Mile Run	200	500	"	4,700	4,700
Corry	"	Hare Creek	207	7,000	"	7,200	7,200
Jamestown	N.Y.	Cassadago Cr.	216	42,500	Primary	67,800	52,400
Falconer	"	" "	217	1,200	"	28,200	27,300
Chautauqua	"	Chautauqua Lake	236	15,000	Septic Tk	15,000	15,000
South Dayton	"	N.Br.Conewango	237	200	None	8,600	8,600
Mt.Jewett	Pa.	Kinzua Creek	235	1,400	"	7,000	7,000
Bradford	"	Tunungwant Cr.	252	18,000	"	20,900	20,900
122 Smaller Sources				118,200	(2)	130,600	94,400
Total - New York				110,500		186,700	155,600
Pennsylvania				809,300		1,411,500	1,358,800
Total - Entire Basin				919,800		1,598,200	1,514,400

(1) Treatment plant ineffective.
(2) Eighteen primary and seventeen secondary sewage treatment plants.
(3) Pollution loads from Pittsburgh and Suburbs are distributed to Allegheny and Monongahela Basins and Main Ohio River as follows:

Pittsburgh	Pa.	Allegheny River	0-8	320,500	None	597,200	597,200
and	"	Monongahela R.	0-10	319,500	"	458,500	458,500
Suburbs	"	Ohio River	0-4(below)	261,700	"	278,600	278,600
Total	"	-	-	901,700	-	1,334,300	1,334,300

Table A-4 Allegheny River Basin - Summary of Industrial Wastes not Discharging to Municipal Treatment Plants, with Total of Entire Industrial Waste Load in the Basin.

Industry	Number of Plants	Industrial Waste Disposal		At Least Minor Corrective Measures Taken	Estimated Sewered Population Equivalent (B.O.D.)
		Munic. Sewers	Private Outlets		
Brewing	7	7	0	5	53,800
By-Product Coke	2	0	2	2	84,000
Canning	3	0	3	2	57,900
Chemical	7	0	7	6	9,600
Distilling	3	0	3	3	19,600
Meat	15	10	5	11	90,600
Milk	44	14	30	13	17,900
Oil	25	0	25	23	35,900
Paper	3	0	3	2	94,400
Steel	27	6	21	11	-
Tanning	11	0	11	6	63,700
Textile	8	2	6	4	124,300
Miscellaneous	41	12	29	5	21,500
Waste Not Connected Munic. Treatment	196	51	145	93	673,200
Waste Discharged to Municipal Treatment					5,200
Total Industrial Waste in the Basin					678,400
By States - New York					76,200
Pennsylvania					602,200



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OHIO RIVER POLLUTION SURVEY
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1941

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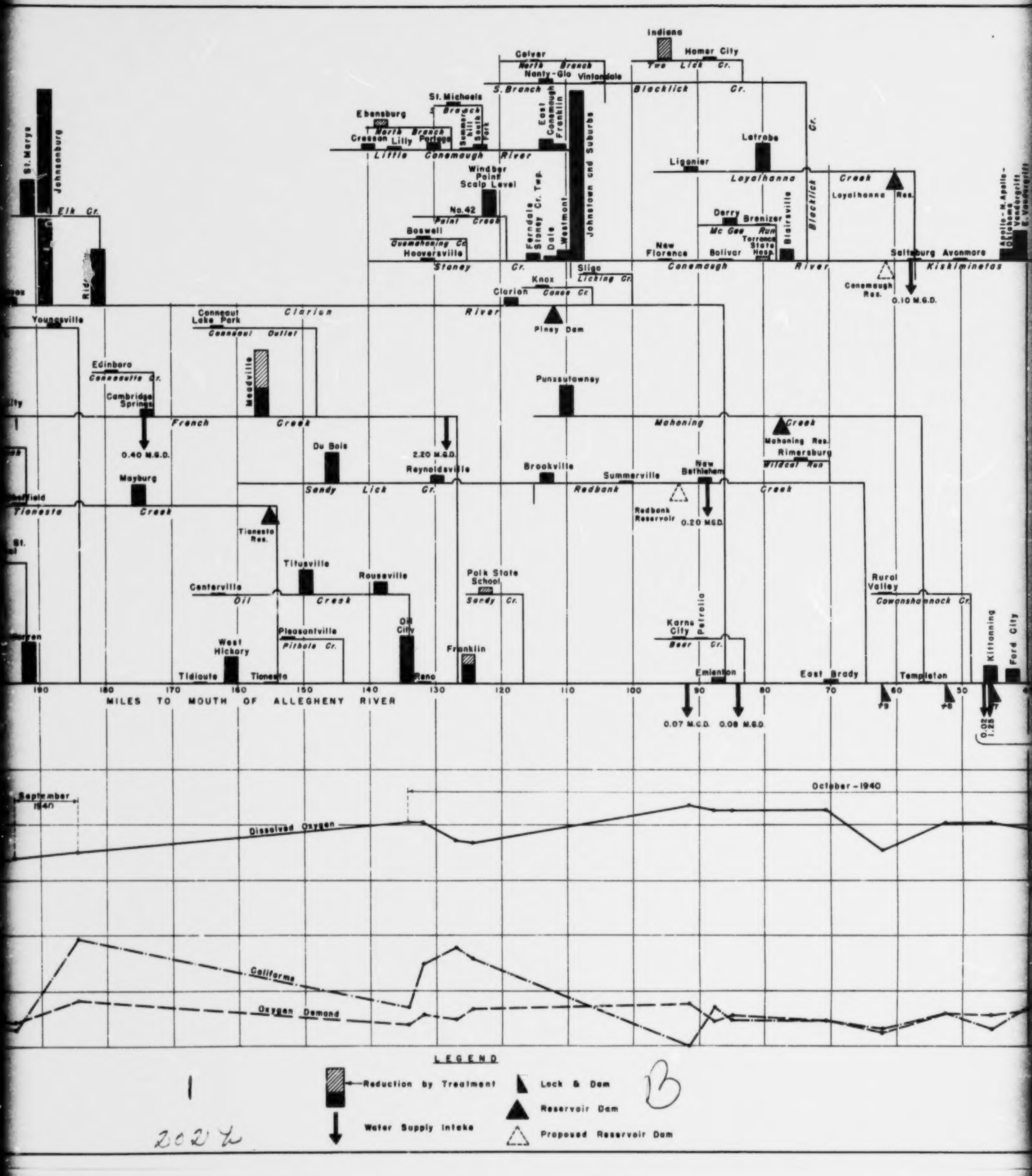


Indiana
Homer City
Two Lick Cr.
Colver
North Branch
Nanty-Glo
Vintondale
S. Branch
Blacklick Cr.
St. Michaels
S. Branch
Summerhill
South Fork
Ebensburg
North Branch
Cresson
Lilly
Portage
Little Conemaugh River
East Conemaugh
Franklin
Johnstown and Suburbs
Latrobe
Ligonier
Loyalhanna Creek
Loyalhanna Res.
Blacklick Cr.
Windber
Paint
Scalp Level
No. 42
Paint Creek
Boswell
Quemahoning Cr.
Hooversville
Stoney Cr.
Ferndale
Stoney Cr. Twp.
Dale
Westmont
Derry
Mc Gee Run
Brenizer
Terrance State Hosp.
Blairsville
New Florence
Bolivar
Conemaugh River
Saltsburg
Avonmore
Kiskiminetas
Apollo-N. Apollo
Oklahoma
Vandergrift
E. Vandergrift
Conemaugh Res.
0.10 M.G.D.
St. Marys
Johnsonburg
Elk Cr.
Ridgway
Sligo
Licking Cr.
Knox
Canoe Cr.
Clarion
Clarion River
Piney Dam
Youngsville
Conneaut Lake Park
Conneaut Outlet
Edinboro
Conneautte Cr.
Cambridge Springs
Meadville
French Creek
Punxsutawney
Mahoning Creek
Mahoning Res.
0.40 M.G.D.
2.20 M.G.D.
Du Bois
Reynoldsville
Sandy Lick Cr.
Brookville
Summerville
Redbank Creek
New Bethlehem
Redbank Reservoir
0.20 M.G.D.
Rimersburg
Wildcat Run
Mayburg
Sheffield
Tionesta Creek
Tionesta Res.
St.
Titusville
Rousseville
Oil Creek
Centerville
Polk State School
Sandy Cr.
Rural Valley
Cowanshannock Cr.
Petrolia
Karns City
Bear Cr.
Pleasantville
Pithole Cr.
Oil City
Warren
West Hickory
Tidioute
Tionesta
Reno
Franklin
Emlenton
East Brady
Templeton
Kittanning
Ford City
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
MILES TO MOUTH OF ALLEGHENY RIVER
0.07 M.G.D.
0.08 M.G.D.
#9
#8
#7
0.02
1.25
September 1940
October - 1940
Dissolved Oxygen
Coliforms
Oxygen Demand
LEGEND
▨ Reduction by Treatment
Lock & Dam
▲ Reservoir Dam
Water Supply Intake
△ Proposed Reservoir Dam

1

2024

B

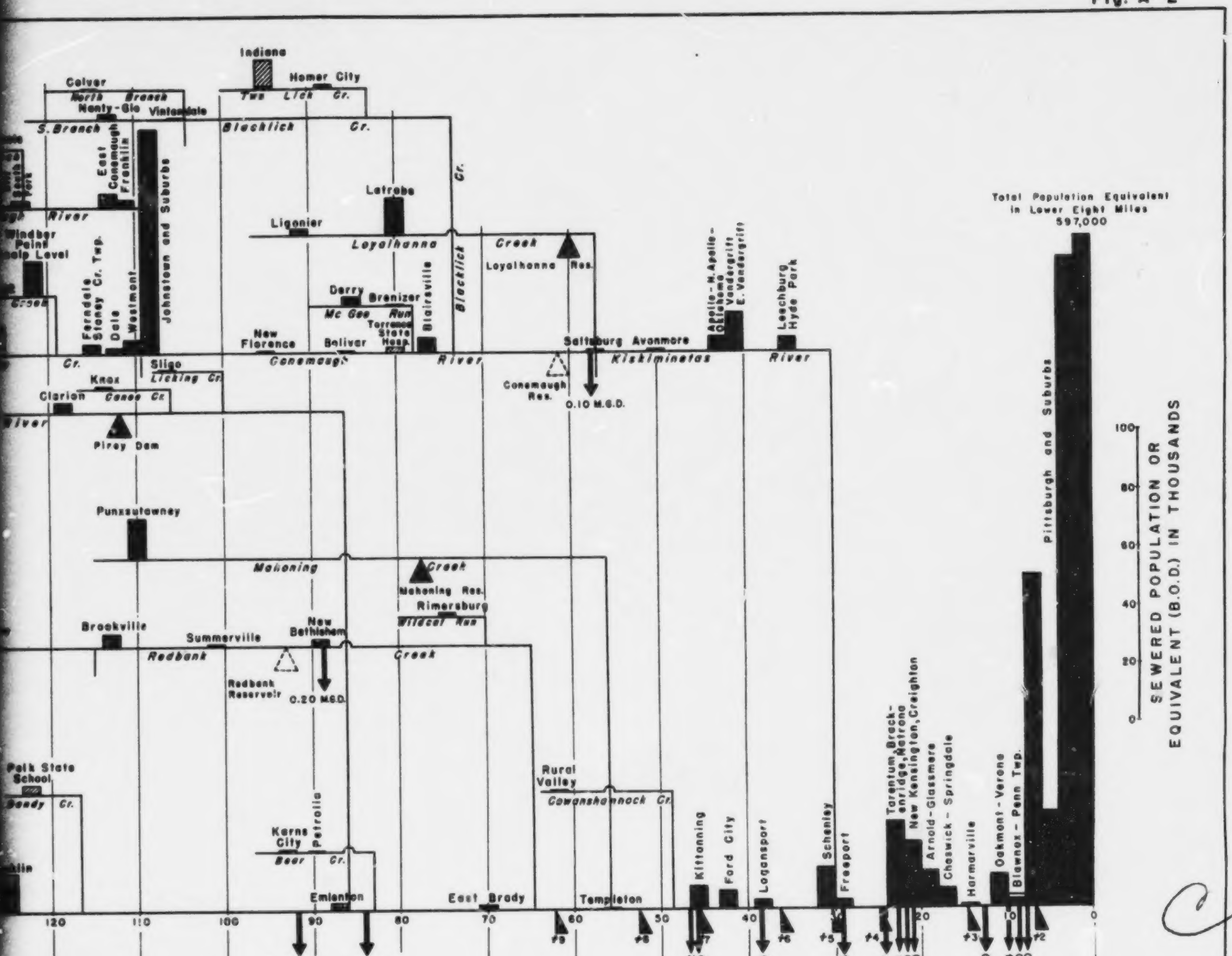


FIGURE A-2

ALLEGHENY RIVER

SOURCES OF POLLUTION
AND
SELECTED LABORATORY DATA

Presentation of Laboratory Data

Laboratory results indicate that the most serious pollution is caused by acid mine drainage which affects tributaries throughout most of the southern part of the basin and the Allegheny River below the mouth of the Kiskiminetas. Industrial wastes discharged to the upper Clarion River and untreated sewage and industrial wastes from the Pittsburgh area near the mouth of the river also cause serious pollution. The greater part of the main stream and most of the tributaries not affected by acid were found to be in good sanitary condition.

A summary of laboratory results are shown in Table A-7, acid results are in Table A-7A, and selected data are in Tables A-5 and A-5A. Observations in the Allegheny River basin were made by mobile laboratory units during the period from August to December, 1940. In general, observations in the southern part of the basin were more extensive than in the northern part. Figures A-3, A-4, A-5, A-5a and A-5b show graphically the coliform, dissolved oxygen, oxygen demand and pH results. Oxygen demand results in the portion of the basin south of Mahoning Creek are shown on an enlarged map (Figure A-5a) because of the large number of stations and the acid conditions in this area. These maps show average results at stations observed for periods of less than one month and most unfavorable monthly averages at stations observed over periods of more than one month. Stream flows at the time of sampling were generally representative of normal low-water conditions.

Bacteriological data indicate the effect of acid in reducing coliform densities. Approximately one-third of the sampling stations were on acid streams and 92 percent of these stations had average coliform counts of less than 50 per ml. Less than three percent showed counts greater than 200 per ml. On the normal streams only 57 percent of the stations averaged less than 50 coliform organisms per ml. and 24 percent averaged more than 200 per ml. Data in Table A-7 on the lower Allegheny, which was affected by acid during part of the sampling period, also indicate the effect of acid on coliform counts.

Eighty-two percent of the stations on normal streams and 85 percent of those on acid streams showed average dissolved oxygen contents of more than 6.5 p.p.m. About 11 percent of the normal stream stations and 5 percent of the acid stations had average dissolved oxygen contents of less than 5.0 p.p.m.

Zero dissolved oxygen was not found consistently at any station although it was approached below Corry, Johnsonburg, Kane, Bradford and Latrobe. Relatively low temperatures prevailed during much of the sampling period, so the dissolved oxygen results show more favorable conditions than would have been found during the warmer months.

Because of the effect of acid on normal biochemical oxidation, the B.O.D. tests on acid stream samples were carried out in duplicate; one portion being incubated in the acid state as collected and the other being incubated after neutralization with sodium hydroxide and seeding with filtered sewage. In general the results of the two portions were either of the same order of magnitude or the acid portion showed a higher B.O.D. than the neutralized portion.

Approximately 75 percent of the stations on both normal and acid streams had average oxygen demands of less than 3.0 p.p.m. About 15 percent of the stations on normal streams and 5 percent of those on acid streams showed average demands over 5.0 p.p.m. The worst conditions were found on tributaries below Kane, St. Marys, Johnsonburg, DuBois, Derry and Ridgway.

Considerable self-purification was indicated by laboratory results on the normal tributaries. Most of these streams were in good sanitary condition at their confluence with the Allegheny River.

Biological Summary - The plankton population of the Allegheny was found to be around 2,000 p.p.m., and the stream supports a good fish population. The Kiskiminetas was too acid to support fish life or much plankton. The Clarion River, contaminated by industrial wastes, contained a good plankton and fish population but the fish are said to be unsuitable for food due to the taste of the flesh.

Table A-5 Allegheny River Basin - Selected Laboratory Data

River	ALLEGHENY RIVER						
Location	above	below	above	below	at	below	above Franklin, Pa.
	Olean, N.Y.		Warren, Pa.		Oil City, Pa.		
River Miles Above: Mouth of Allegheny	261	256.5	194	184.5	134.2	132	127
Period - 1940	Aug.	Aug.	Sept.	Sept.	Oct.	Oct.	Oct.
Number of Samples	3	3	3	3	3	3	3
Flow in c.f.s.: Sampling Days	109	124	658	1,250	1,270	1,350	954
Water Temperature °C.	18.8	18.7	16.2	15.7	12.2	11.5	11.8
Coliforms per ml.	7	92	2	86	5	31	61
Dissolved oxygen ppm.	6.8	4.0	8.5	8.8	10.1	10.1	9.3
B.O.D., 5-day, p.p.m.	2.1	4.5	1.1	2.1	1.0	1.4	1.2
pH	7.1	7.2	7.3	7.4	7.4	7.4	7.3

River	ALLEGHENY RIVER						
Location	below Franklin	Lock #8 Templeton	Lock #5 Freeport	Lock #4 Brackenridge	Lock #3 Springdale	Lock #2 Pittsburgh	near Mouth
River Miles Above: Mouth of Allegheny	124.5	52.6	30.4	24.2	17	6.7	1.7
Period - 1940	Oct.	Sept.	Sept.	Sept.	Sept.	Sept.	Sept.
Number of Samples	3	3	3	3	4	3	2
Flow in c.f.s.: Sampling Days	1,502	3,100	3,350	3,760	4,400	3,510	3,240
Water Temperature °C.	11.5	19.3	19.8	19.8	22.5	21.3	20.8
Coliforms per ml.	39	3.1	37	8	258	357	1,420
Dissolved oxygen ppm.	9.2	8.8	7.8	8.1	8.4	8.5	3.9
B.O.D., 5-day, p.p.m.	1.7	1.7	1.3	0.7	0.9	1.5	4.4
pH	7.4	7.3	7.3	6.3	6.8	6.7	6.8

River Location	Tunungwant Cr. above Bradford	below	Hubert Run below Kane	West Run below	Lake Chautauqua abv. Jamestown	Chadakoin R. at Falconer	Cassadago Cr. below Jamestown
River Miles Above: Conf. with Allegheny	10.5	5.5	27	51	31	26	23.5
Mouth of Allegheny	254.5	249.5	229	205	223	218	215.5
Period - 1940	Aug.	Aug.	Sept.	Sept.	Sept.	Sept.	Sept.
Number of Samples	3	3	3	3	3	3	3
Flow in c.f.s.: Sampling Days	4	33	3	4	-	265	297
Water Temperature °C.	14.2	15.7	13.7	12.0	16.8	16.2	17.0
Coliforms per ml.	16	2,340	120,300	99	24	197	191
Dissolved oxygen ppm.	9.2	2.0	1.9	7.5	9.8	8.5	7.6
B.O.D., 5-day, p.p.m.	1.3	6.0	69.4	3.4	2.3	2.9	4.2
pH	7.2	7.1	7.0	6.8	8.2	7.4	7.5

River Location	Hare Creek below Corry	Oil Creek above Titusville	below	French Cr. above Meadville	below	Sandy Lick Cr. below DuBois	McGee Run below Derry
River Miles Above: Conf. with Allegheny	22	19	15	35	26	73.5	54
Mouth of Allegheny	206	153	149	161.5	152.5	138.5	84
Period - 1940	Sept.	Oct.	Oct.	Oct.	Oct.	Sept.-Oct.	Oct.
Number of Samples	3	3	3	3	3	3	1
Flow in c.f.s.: Sampling Days	11	8	10	122	164	19	2
Water Temperature °C.	11.0	11.0	10.8	13.1	13.6	9.5	15.0
Coliforms per ml.	38,200	4	42	5	523	31,300	24,000
Dissolved oxygen ppm.	0.2	10.7	10.3	9.5	3.7	6.6	4.2
B.O.D., 5-day, p.p.m.	16.6	1.4	1.5	3.2	4.2	37.9	33.1
pH	7.1	7.5	7.5	7.5	7.2	-	-

River	CLARION RIVER					Elk Creek below St. Marys	Crooked Creek Reservoir
Location	in Johnsonburg	above Ridgway	below Ridgway	at Cooksburg	at St. Petersburg		
River Miles Above: Conf. with Allegheny	101	96.5	93	51	4.5	104	8.5
Mouth of Allegheny	187	182.5	179	137	90.5	190	49
Period - 1940	Sept.-Oct.	Sept.-Oct.	Sept.-Oct.	Oct.	Oct.	Sept.-Oct.	Nov.
Number of Samples	6	6	6	5	3	3	1
Flow in c.f.s.: Sampling Days	60	82	104	219	271	4	-
Water Temperature °C.	19.4	9.5	10.1	11.6	11.3	10.3	9.0
Coliforms per ml.	3,910	3,950	2,580	32	2	4,830	2
Dissolved oxygen ppm.	0.5	2.8	3.8	7.4	9.9	6.6	9.7
B.O.D., 5-day, p.p.m.	190	35.8	40.3	12.1	1.2	40.2	1.3
pH	7.2	7.1	6.4	7.1	7.2	6.3	6.9

River Location	Mahoning Cr. below Punx'twny	Stony Creek abv. Johnstown	Little Conemaugh	Conemaugh below Johnstown	Loyalhanna Cr. above Latrobe	below	Kiskiminetas near Mouth
River Miles Above: Conf. with Allegheny	53	93.5	83	78	52.5	48	0.8
Mouth of Allegheny	109	123.5	113	108	82.5	78	31
Period - 1940	Oct.	July-Aug.	July-Aug.	July-Aug.	Oct.	Oct.	Sept.
Number of Samples	3	3	3	3	1	1	3
Flow in c.f.s.: Sampling Days	41	248	62	460	14	15	690
Water Temperature °C.	10.5	20.8	23.5	29.3	15.0	15.0	19.5
Coliforms per ml.	8	37	1	39	*	*	*
Dissolved oxygen ppm.	11.1	7.8	7.0	4.6	9.1	1.8	7.6
B.O.D., 5-day, p.p.m.	1.1	1.0	0.6	3.6	0.7	3.1	1.3
" 5-day ppm.(neutralized & seeded)	1.6	0.6	0.5	2.0	0.4	1.3	0.8
pH	6.0	3.0	2.8	4.1	4.5	3.1	2.9

* Less than one.

Table A-5A Allegheny River Basin - Selected Laboratory Chemical Data

River Location	Allegheny River Mouth Pittsb'gh	Lock & Dam #3	Lock & Dam #4	Kiski-minetas Mouth	Loyal-hanna Mouth	Crabtree Creek Mouth	Conemaugh Mouth
River Miles Above:							
Conf. with Allegheny	-	-	-	1.	28	42	28
Mouth of Allegheny	1.7	17	24.2	31	58	72	58
Period - 1940	Oct.9	Oct.21	Oct.	Oct.	Oct.14	Oct.29	Oct.14
Number of Samples	1	1	2	5	1	1	1
Flow in c.f.s.:							
Sampling Days	2,760	2,750	2,560	419	36	13	275
Minimum Month	-	-	-	90	16	-	-
pH	4.7	5.7	5.6	2.9	2.6	3.1	2.8
Acidity p.p.m.:							
Methyl Red	4	3	5	200	494	1,910	176
Phenolphthalein(Hot)	10	10	13	282	608	2,930	242
Iron total p.p.m.	2.4	0.7	7.5	9.8	79	494	26

River Location	Blacklick Creek below Blackl'k	So.Br. Mouth	Stony Creek Johnstown	Cowan-shannock Creek	Mahoning Creek Punx't'ny	Clarion Portland Mills	Toby Cr. Portland Mills
River Miles Above:							
Conf. with Allegheny	51	76	79.5	11.5	52.8	86.9	85.9
Mouth of Allegheny	81	106	109.5	60	109	173	172
Period - 1940	Oct.14	Aug.	July	Oct.24	Oct.2	Oct.9	Oct.9
Number of Samples	1	2	2	1	1	1	1
Flow in c.f.s.:							
Sampling Days	40	16	430	2	36	135	26
Minimum Month	-	-	30	-	-	-	-
pH	2.4	2.6	3.0	2.9	5.2	4.7	3.0
Acidity p.p.m.:							
Methyl Red	612	811*	78	248	-	32	244
Phenolphthalein(Hot)	788	1,047*	114	398	34	56	284
Iron total p.p.m.	98	222	66	75	4	4	6

* One sample.

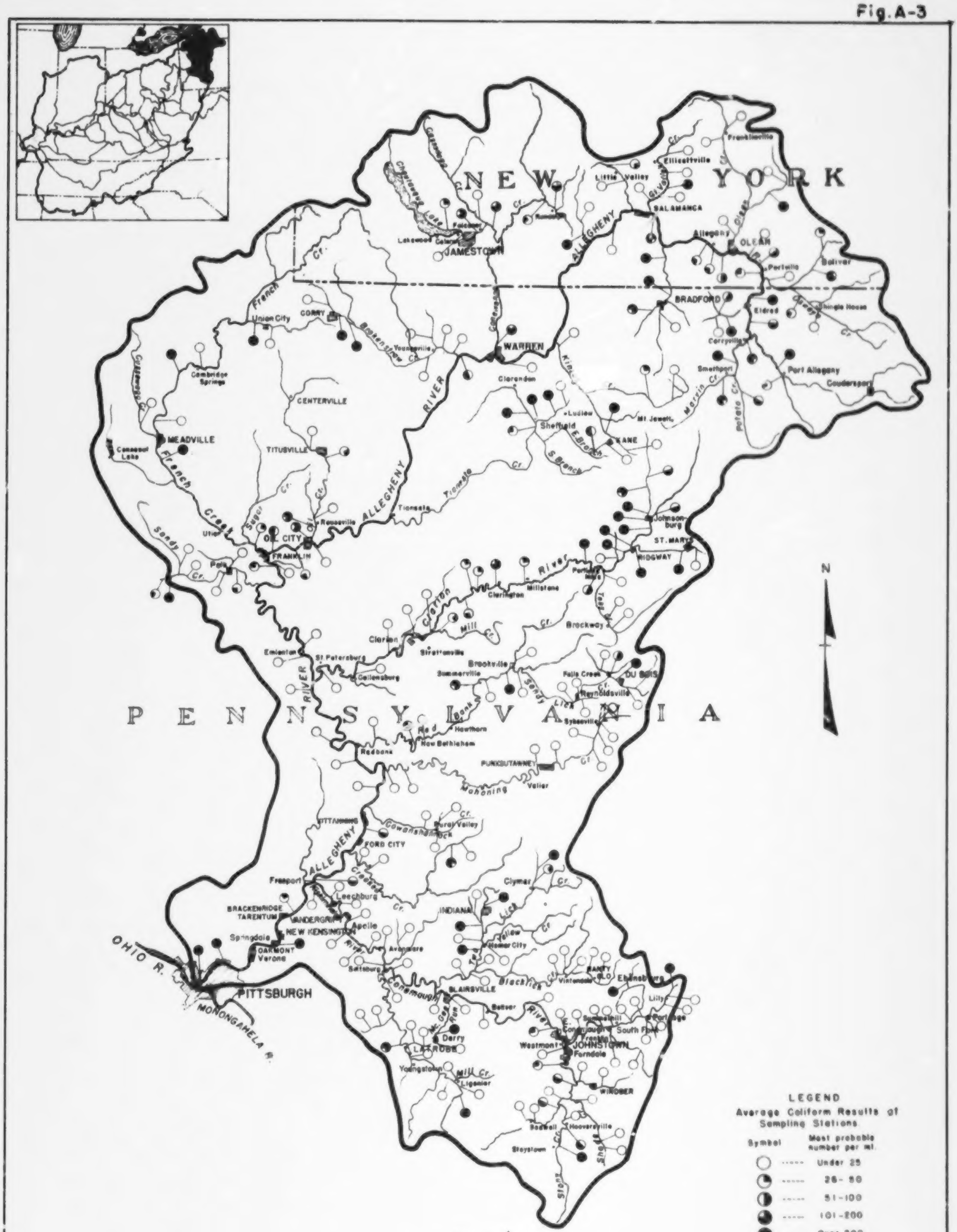

NEW YORK
PENNSYLVANIA
N
Chautauqua Lake
JAMESTOWN
Lakewood
Celoron
Falconer
Little Valley
Ellicottville
SALAMANCA
Franklinville
Allegany
OLEAN
Portville
Bolivar
BRADFORD
Eldred
Shinglehouse
Coudersport
Port Allegany
Smethport
Corryville
Union City
CORRY
Youngsville
WARREN
Clarendon
French Cr.
Cambridge Springs
CENTERVILLE
MEADVILLE
Conneaut Lake
TITUSVILLE
Tionesta
Rouseville
OIL CITY
Utica
FRANKLIN
Polk
Sandy Cr.
ALLEGHENY RIVER
Sheffield
Ludlow
Mt. Jewett
KANE
Johnsonburg
ST. MARYS
RIDGWAY
Clarion River
Clarington
Millstone
Brockway
Clarion
Strattonville
Emlenton
St. Petersburg
Callensburg
Brookville
Summerville
Falls Creek
DU BOIS
Reynoldsville
Sykesville
Hawthorn
New Bethlehem
Redbank
PUNXSUTAWNEY
Mahoning
Valier
KITTANNING
FORD CITY
Rural Valley
Freeport
Leechburg
BRACKENRIDGE
TARENTUM
VANDERGRIFT
NEW KENSINGTON
Apollo
Springdale
OAKMONT
Verona
OHIO R.
PITTSBURGH
MONONGAHELA R.
Clymer
INDIANA
Homer City
Avonmore
Saltsburg
Conemaugh
BLAIRSVILLE
Blacklick
Vintondale
Nanty Glo
Ebensburg
Lilly
Portage
Summerhill
South Fork
Derry
LATROBE
Westmont
JOHNSTOWN
Ferndale
Youngstown
Ligonier
WINDBER
Boswell
Hooversville
Stoystown
Stony Cr.
LEGEND
Average Coliform Results of Sampling Stations
Symbol
Most probable number per ml.
○ ----- Under 25
◔ ----- 26-50
◑ ----- 51-100
◕ ----- 101-200
● ----- Over 200
10 0 10 20
SCALE OF MILES

Fig. A-3

ALLEGHENY BASIN

COLIFORM RESULTS

OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941

Fig. A-4

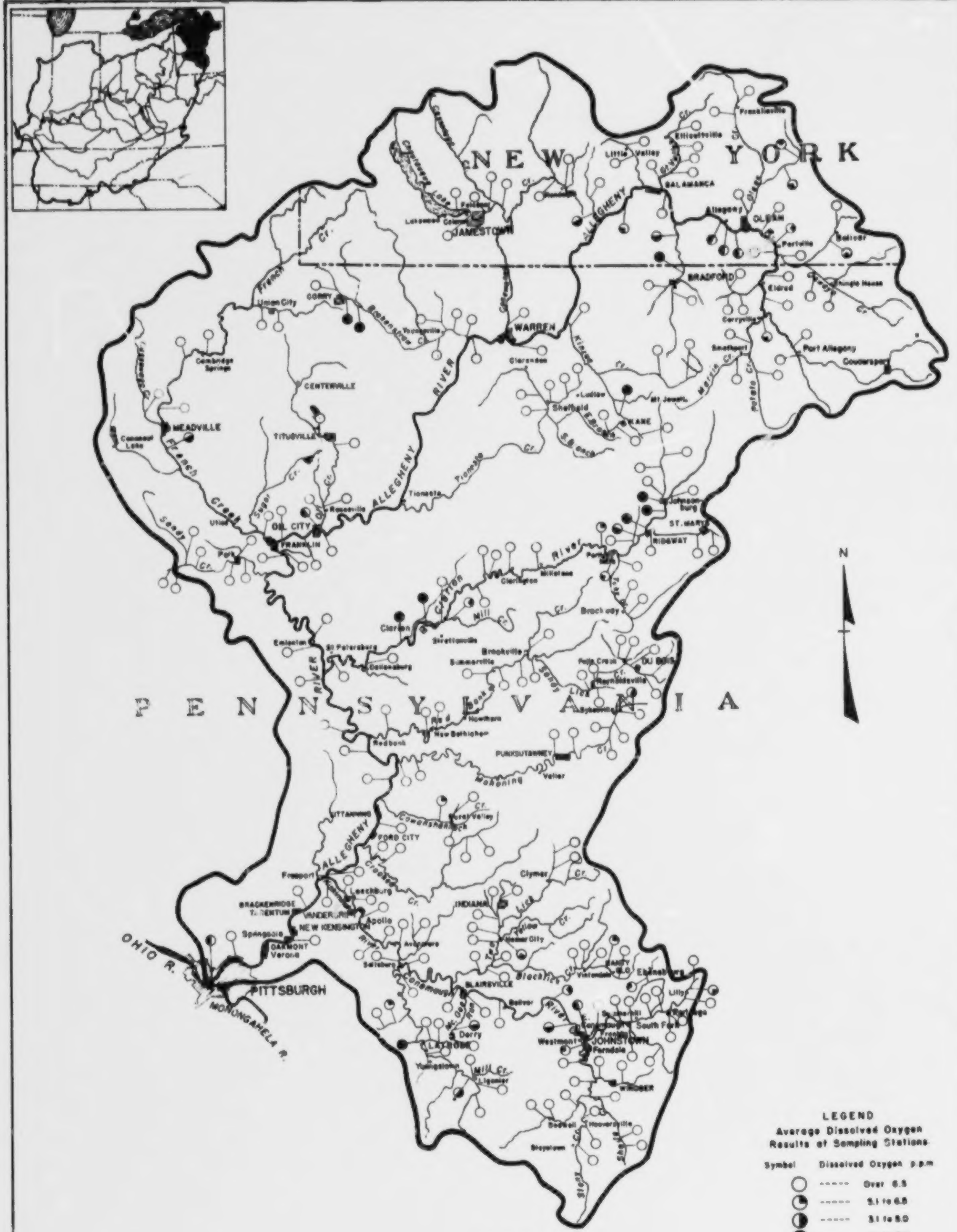

NEW YORK
PENNSYLVANIA
OHIO R.
MONONGAHELA R.
ALLEGHENY RIVER
PITTSBURGH
JAMESTOWN
WARREN
BRADFORD
OLEAN
SALAMANCA
MEADVILLE
TITUSVILLE
OIL CITY
FRANKLIN
CENTERVILLE
CORRY
Union City
Cambridge Springs
KANE
Sheffield
Ridgway
ST. MARYS
Johnsonburg
DU BOIS
Brookville
Clarion
PUNXSUTAWNEY
KITTANNING
FORD CITY
Freeport
INDIANA
BLAIRSVILLE
JOHNSTOWN
LATROBE
Ligonier
Ebensburg
Clarendon
Tionesta
Port Allegany
Coudersport
Smethport
Eldred
Portville
Bolivar
Ellicottville
Franklinville
Little Valley
Emlenton
Redbank
New Kensington
Vandergrift
Leechburg
Apollo
Springdale
Oakmont
Verona
Brackenridge
Tarentum
French Cr.
Conewango Cr.
Kinzua Cr.
Clarion River
Mahoning Cr.
Crooked Cr.
Kiskiminetas River
Conemaugh River
Blacklick Cr.
Stony Cr.
Oil Cr.
Sandy Cr.
Tionesta Cr.
N
LEGEND
Average Dissolved Oxygen Results of Sampling Stations
Symbol
Dissolved Oxygen p.p.m
○ ----- Over 6.5
◔ ----- 5.1 to 6.5
◑ ----- 3.1 to 5.0
● ----- 0.1 to 3.0

Fig. A-4

ALLEGHENY BASIN

DISSOLVED OXYGEN RESULTS

10 0 10 20
SCALE OF MILES

OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941

Fig. A-5

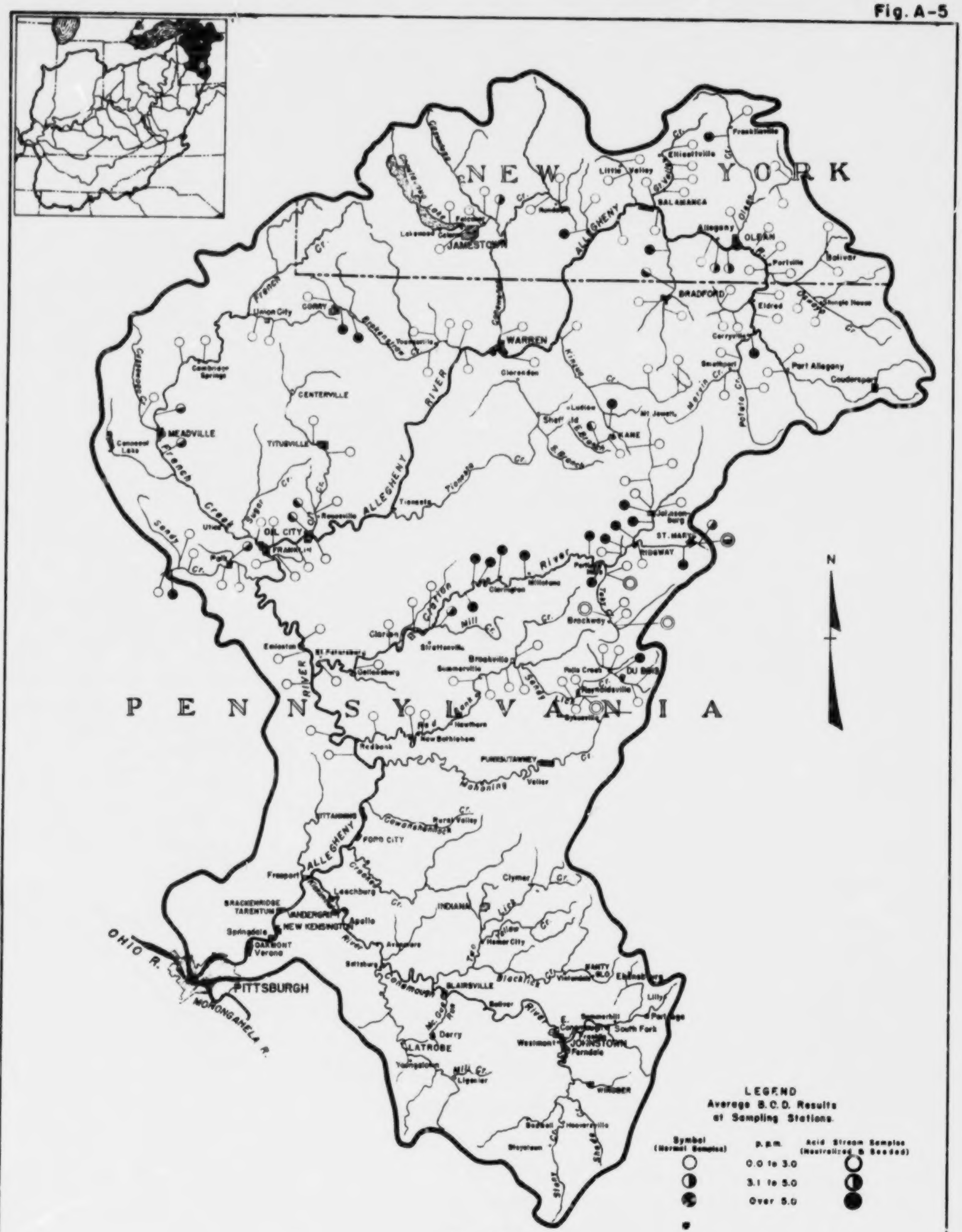

NEW YORK
PENNSYLVANIA
OHIO R.
MONONGAHELA R.
ALLEGHENY RIVER
PITTSBURGH
JAMESTOWN
WARREN
BRADFORD
OLEAN
SALAMANCA
MEADVILLE
TITUSVILLE
OIL CITY
FRANKLIN
CENTERVILLE
CORRY
Union City
KANE
ST. MARYS
RIDGWAY
DU BOIS
Brockway
Punxsutawney
INDIANA
BLAIRSVILLE
LATROBE
JOHNSTOWN
NEW KENSINGTON
TARENTUM
Freeport
KITTANNING
FORD CITY
Leechburg
Apollo
Port Allegany
Coudersport
Smethport
Clarion
Emlenton
Tionesta
Kinzua Cr.
French Cr.
Conewango Cr.
Clarion River
Redbank Cr.
Mahoning Cr.
Conemaugh R.
Kiskiminetas R.
Crooked Cr.
Oil Cr.
Sandy Cr.
LEGEND
Average B.O.D. Results at Sampling Stations
Symbol (Normal Samples)
p.p.m.
Acid Stream Samples (Neutralized & Seeded)
○ 0.0 to 3.0
◐ 3.1 to 5.0
● Over 5.0
N

Fig. A-5

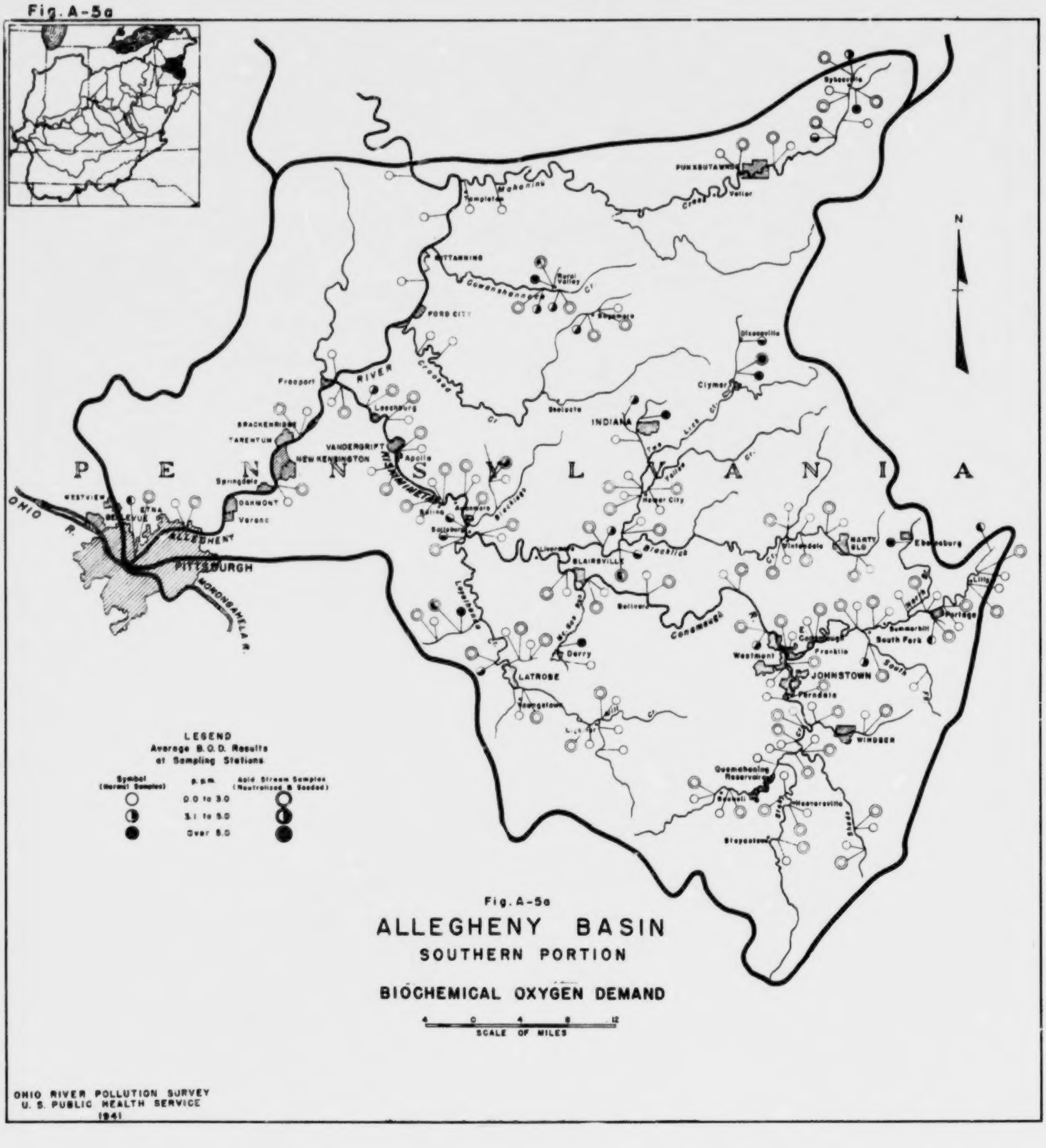
ALLEGHENY BASIN

BIOCHEMICAL OXYGEN DEMAND

10 0 10 20
SCALE OF MILES

OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941

Fig. A-5a



P E N N S Y L V A N I A
OHIO R.
WESTVIEW
BELLEVUE
ETNA
ALLEGHENY
PITTSBURGH
MONONGAHELA R.
Verona
OAKMONT
Springdale
NEW KENSINGTON
TARENTUM
BRACKENRIDGE
Freeport
RIVER
Leechburg
VANDERGRIFT
Apollo
KISKIMINETAS
Saltsburg
Crooked Cr.
FORD CITY
KITTANNING
Cowanshannock Cr.
Rural Valley
Templeton
Mahoning
PUNXSUTAWNEY
Sykesville
Creek
Clymer
INDIANA
Two Lick Cr.
Yellow Cr.
Homer City
Blacklick
BLAIRSVILLE
Livermore
Bolivar
Conemaugh R.
Loyalhanna Cr.
LATROBE
Derry
Youngstown
Ligonier
Vintondale
NANTY GLO
Ebensburg
Lilly
Portage
Summerhill
South Fork
E. Conemaugh
Franklin
Westmont
JOHNSTOWN
Ferndale
WINDBER
Quemahoning Reservoir
Boswell
Hooversville
Stoystown
N
LEGEND
Average B.O.D. Results
at Sampling Stations
Symbol (Normal Samples)
p.p.m.
Acid Stream Samples (Neutralized & Seeded)
○ 0.0 to 3.0 ○
◐ 3.1 to 5.0 ◐
● Over 5.0 ●
4 0 4 8 12
SCALE OF MILES

Fig. A-5a

ALLEGHENY BASIN

SOUTHERN PORTION

BIOCHEMICAL OXYGEN DEMAND

OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941

Fig. A-5b

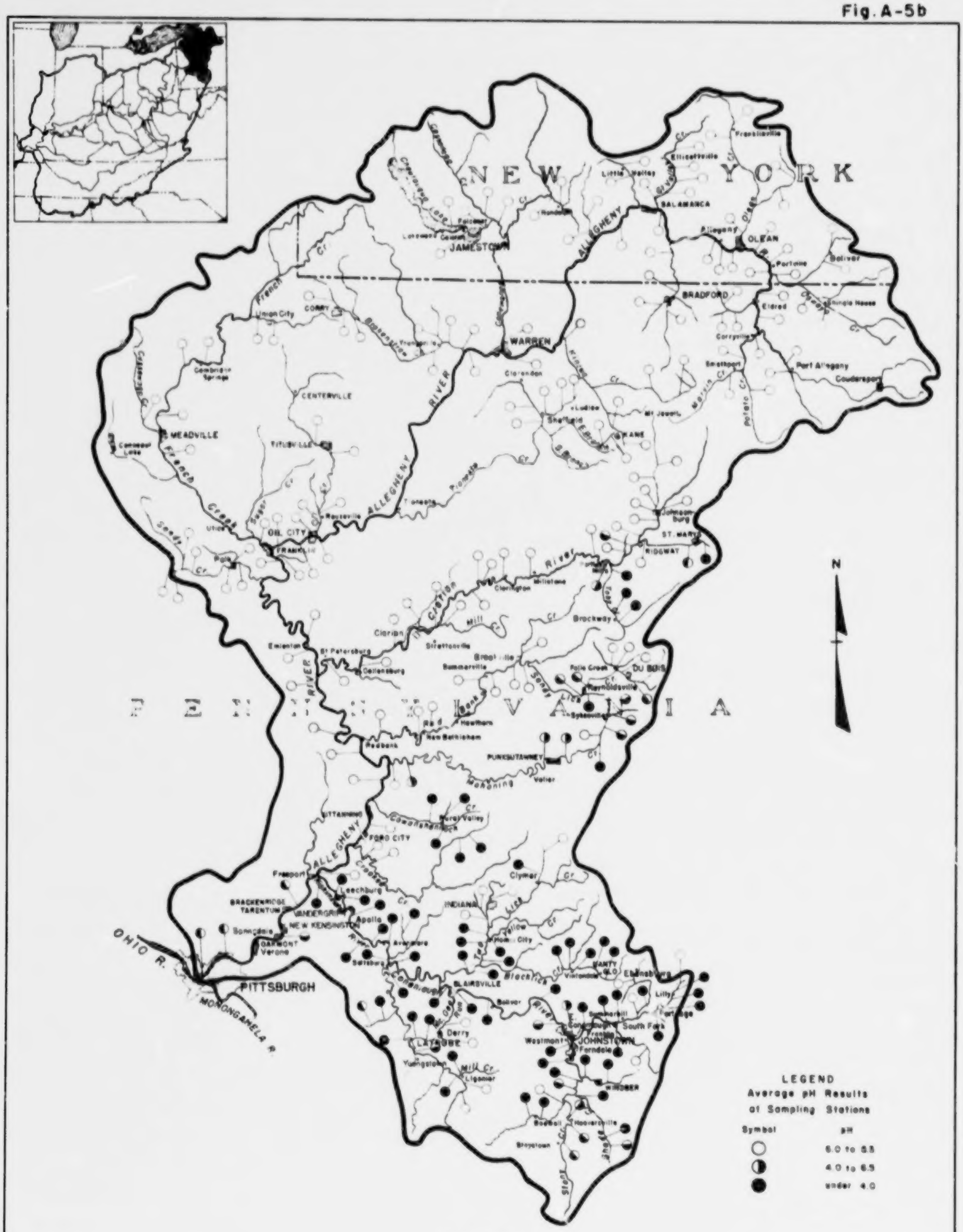

NEW YORK
PENNSYLVANIA
JAMESTOWN
OLEAN
SALAMANCA
Ellicottville
Franklinville
Little Valley
Allegany
Portville
Bolivar
BRADFORD
Eldred
Shinglehouse
Corryville
Smethport
Port Allegany
Coudersport
WARREN
Clarendon
Sheffield
Ludlow
KANE
Mt Jewett
Johnsonburg
ST. MARYS
RIDGWAY
Union City
CORRY
Cambridge Springs
CENTERVILLE
MEADVILLE
Conneaut Lake
TITUSVILLE
Tionesta
OIL CITY
FRANKLIN
Utica
Polk
Clarington
Brockway
Clarion
Strattonville
Emlenton
St Petersburg
Callensburg
Summerville
Brookville
DU BOIS
Falls Creek
Reynoldsville
Sykesville
Hawthorn
New Bethlehem
Redbank
PUNXSUTAWNEY
Valier
KITTANNING
FORD CITY
Rural Valley
Clymer
Freeport
BRACKENRIDGE
TARENTUM
VANDERGRIFT
NEW KENSINGTON
Leechburg
Apollo
Avonmore
Saltsburg
INDIANA
Homer City
Springdale
OAKMONT
Verona
PITTSBURGH
BLAIRSVILLE
Bolivar
Vintondale
NANTY GLO
Ebensburg
Lilly
Portage
South Fork
JOHNSTOWN
Westmont
Ferndale
Derry
LATROBE
Youngstown
Ligonier
WINDBER
Hooversville
Boswell
Boyntown
ALLEGHENY RIVER
OHIO R.
MONONGAHELA R.
Conewango Cr.
French Cr.
Brokenstraw Cr.
Kinzua Cr.
Clarion River
Redbank Cr.
Mahoning Cr.
Crooked Cr.
Kiskiminetas R.
Conemaugh R.
Loyalhanna Cr.
Blacklick Cr.
Stony Cr.
N
LEGEND
Average pH Results
of Sampling Stations
Symbol
pH
○ 6.0 to 8.5
◐ 4.0 to 6.5
● under 4.0

Fig. A-5b

ALLEGHENY BASIN

pH RESULTS

10 0 10 20
SCALE OF MILES

OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941

Hydrometric Data

Eighteen stream gaging stations are now in operation in the Allegheny River Basin. Several of the stations have records of 30 years or more. Table A-6 shows mean monthly flows at 16 stations during the dryest summers of record. Figure A-6 indicates the frequency with which minimum monthly mean summer flows have occurred at two stations with long records.

Station	Minimum Monthly Mean Summer Flows in Cubic Ft. per Sec. that May Be Expected Once in			
	2 Years	5 Years	10 Years	Minimum
Allegheny River at Kittaning, Pa.	2200	1450	1200	930
Kiskiminetas River at Avonmore, Pa.	550	320	230	90

Flow Regulation - The following reservoirs in the Allegheny River Basin are a part of the authorized program for flood control primarily for the protection of Pittsburgh. Each of the reservoirs is named for the stream on which it is located.

Reservoir	Mile (1)	Status	Net Capacity Acre-feet	Flow Available with Regulation c.f.s.(2)
Crooked Cr.	47	Completed	89,500	97
Tionesta	155	"	125,600	188
Mahoning Cr.	78	"	69,500	107
Loyalhanna Cr.	62	"	93,500	146
Conemaugh R.	65	Proposed	270,000	Natural flow
Allegheny R.	201	"	1,105,000	1,927
Red Bank	93	"	139,000	226
French Cr.	171	"	117,000	230

(1) Location of dam in river miles above mouth of Allegheny River.

(2) Maximum dependable flow at dam site during drought period July to November 1930 under one possible plan of reservoir operation. With the exception of the Allegheny River reservoir, present plans contemplate operations for flood control only.

Studies in progress indicate the desirability of substituting a system of small reservoirs for the large French Creek reservoir. Among the projects receiving consideration in this connection are reservoirs on Sugar Creek (mile 138*), Lake Creek (mile 140*) and Sandy Creek (mile 134*). The first two are tributaries of French Creek, the last is a tributary of the Allegheny about 10 miles downstream from French Creek. Studies have indicated the economic feasibility of a multiple - purpose reservoir project on the Clarion River at the Mill Creek site, 121 river miles above Pittsburgh, Pennsylvania. The flows shown in the above table are those which could be maintained below the dam sites during the period July to November, 1930, the lowest flow period of record at Pittsburgh, by using a portion of the flood control storage for flow regulation after the end of the flood season, except in the cases of the Conemaugh River and Allegheny River reservoirs. At the Conemaugh River site the storage capacity would be limited by physical considerations so that it is undesirable to use any of it for low-flow regulation even during the normally dry season. At the Allegheny River site ample storage capacity would be available and it is proposed to provide 195,000 acre-feet of storage expressly for low-flow regulation in addition to capacity which would be available seasonally as an incidental feature of flood control operations.

In addition to these large projects a smaller one has been studied by the U. S. Engineer Department primarily for local protection at Jamestown, New York. The project involves improvements to the channel of the Chadakoin River (the outlet of Lake Chautauqua) and a better scheme of operation of the existing dam which regulates the outflow from Lake Chautauqua. The proposed operating scheme would limit the outflow to about 5 c.f.s. during the summer months.

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*Location of dam in river miles above mouth of Allegheny River.

Table A-6 Allegheny River Basin - Monthly Mean Summer Flows for
Years in Which Lowest Summer Flows have Occurred.

River Location	Allegheny R. Larabee, Pa.	Allegheny R. Red House, N.Y.	Allegheny R. Franklin, Pa.	Allegheny R. Kittanning, Pa.	Chadakoin R. Falconer, N.Y.
River Miles Above:					
Conf.with Allegheny	-	-	-	-	25
Mouth of Allegheny	276	227	126	46	217
Drain.Area Sq.Mi.	541	1,690	5,982	9,010	194
Period of Record	1925-39	1903-39	1918-39	1904-28	1935-39
Year	1930	1932	1930	1909	1936
June c.f.s.	265	809	3,030	12,014	54
July "	64	553	1,140	3,234	38
August "	21	178	414	1,421	32
September "	24	118	435	934	23
Year	1932	1930	1932	1908	1939
June "	304	1,030	2,510	9,522	35
July "	122	337	2,080	9,105	42
August "	35	119	754	2,743	46
September "	23	122	531	996	29
Year	1934	1934	1934	1923	1935
June "	99	299	1,106	3,640	119
July "	34	150	555	1,600	124
August "	45	144	639	1,400	199
September "	83	233	821	1,190	43

River Location	Brokenstraw Cr. Youngsville, Pa.	Oil Creek Rouseville, Pa.	French Creek Saegerstown, Pa.	Clarion R. Piney, Pa.	Redbank Cr. St. Charles, Pa.
River Miles Above:					
Conf.with Allegheny	4	3	36	26	15
Mouth of Allegheny	188	137	163	112	80
Drain.Area Sq.Mi.	304	300	629	980	528
Period of Record	1909-39	1909-39*	1921-39	1924-39	1909-39
Year	1934	1930	1934	1925	1918
June c.f.s.	62	130	85	601	1,234
July "	38	71	48	559	122
August "	32	31	39	178	15
September "	32	34	36	81	37
Year	1936	1934	1930	1930	1930
June "	149	75	295	471	176
July "	59	38	115	245	265
August "	37	39	41	88	34
September "	32	34	70	87	46
Year	1930	1932	1936	1932	1932
June "	313	117	136	432	247
July "	57	112	79	431	310
August "	50	45	60	118	94
September "	32	35	48	88	45

River Location	Mahoning Cr. Dayton, Pa.	Crooked Cr. Ford City, Pa.	Stony Creek Johnstown, Pa.	Loyalhanna Cr. New Alexandria, Pa.	Kiskiminetas Avonmore, Pa.
River Miles Above:					
Conf.with Allegheny	28	5	81	40	22
Mouth of Allegheny	84	46	111	70	52
Drain.Area Sq.Mi.	321	280	467	265	1,723
Period of Record	1916-39	1909-39	1914-35	1919-39	1907-37
Year	1930	1930	1922	1932	1908
June c.f.s.	113	91	210	80	1,134
July "	54	20	170	43	608
August "	18	2.7	62	26	358
September "	23	4.0	30	16	90
Year	1939	1932	1925	1939	1910
June "	194	45	221	122	2,825
July "	171	72	232	127	697
August "	56	8.3	90	33	192
September "	27	3.2	32	22	693
Year	1925	1925	1914	1930	1909
June "	137	32	446	489	2,494
July "	157	153	230	50	431
August "	70	26	66	24	397
September "	29	6.3	34	37	217

* From 1909-31 Station located 2 miles downstream, drainage area 330 square miles.

Fig. A-6

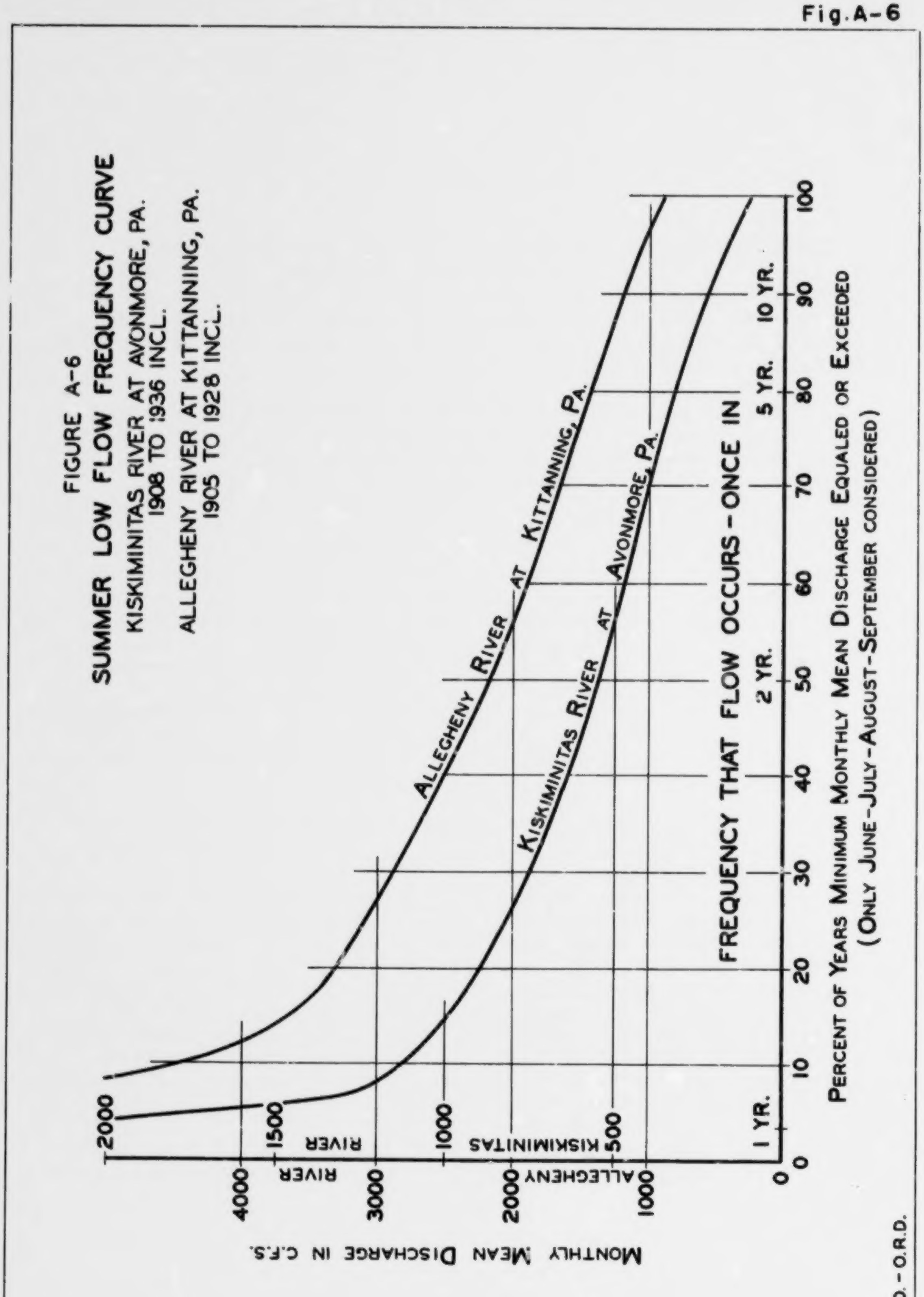

FIGURE A-6

SUMMER LOW FLOW FREQUENCY CURVE

KISKIMINITAS RIVER AT AVONMORE, PA.
1908 TO 1936 INCL.

ALLEGHENY RIVER AT KITTANNING, PA.
1905 TO 1928 INCL.

U.S.E.D. - O.R.D.

Discussion

The major pollution problems in the Allegheny River Basin are: (1) control of acid mine drainage, (2) abatement of industrial wastes, particularly in the Clarion Basin, and (3) treatment of domestic sewage, particularly in the vicinity of Pittsburgh. In addition there are a number of other problems of a more local nature.

Control of acidity can best be accomplished by a program of including mine sealing supplemented by flow regulation. This matter is more fully discussed in a separate section of this report on "Acid Mine Drainage." It is estimated that reservoir capacity of at least 210,000 acre-feet in this basin will be required for low-flow regulation. Of this, a portion could be made available at the four reservoirs already completed. The entire amount could also be provided in the proposed Allegheny River reservoir where the water quality would be good. One of the completed reservoirs, LoyalhannaCreek, is on a stream so heavily polluted with acid mine drainage that low-flow regulation by it might have a deleterious effect on the water quality of the Allegheny River. Although Mahoning Creek and Crooked Creek, on which two of the other completed reservoirs are located, also receive some acid mine drainage, they are less acid than Loyalhanna Creek and low-flow regulation by these two reservoirs would be beneficial.

Pittsburgh and Vicinity - More than 400,000 people discharge untreated sewage to the Allegheny River in the lower 30 miles below the mouth of the Kiskiminetas. Industrial wastes add a population equivalent of about 280,000. Most of this pollution enters the lower eight miles below the nine public water supply intakes on the Allegheny but sewage from about 80,000 people enters the stream above the intakes of the two largest water supplies in the basin. Primary treatment and chlorination of all municipal sewage in this area seems justified. All or most of the wastes entering the lower eight miles of the Allegheny probably could be most economically treated, with wastes from other parts of Pittsburgh, at a large plant on the Ohio River.

The problem of the city of Pittsburgh is discussed and cost estimates are included in the report on the main Ohio River.

Kiskiminetas River - This stream is the most highly acid large stream in the entire Ohio River Basin. While great improvement is possible, a comprehensive program of mine sealing could probably not restore it nor many of its tributaries to an alkaline condition until concentrated active mining moves, at least in part, to other areas. Sewage from about 185,000 people and industrial wastes equivalent in oxygen demand to sewage from an additional 95,000 enter the streams in this area. The largest city is Johnstown, located at the junction of the Little Conemaugh River and Stony Creek, about 70 miles above the mouth of the Kiskiminetas. Almost all of the industrial waste load and about 45 percent of the sewage enters the streams in Johnstown and vicinity. Justification of organic pollution abatement at most of the communities on highly acid streams is doubtful in the absence of effective acid control and, in general, the present need for sewage treatment at such places is not urgent. The immediate need is for a program to reduce the acidity of the streams. In conjunction with such a program, in some instances primary, and in other instances secondary treatment of sewage and organic industrial wastes will be necessary depending on the particular situation and on the degree of acid reduction attained. At Derry, located on a small stream not affected by acid, secondary treatment is indicated.

Allegheny River above Kiskiminetas - This section of the Allegheny River is relatively clean and always alkaline. The largest cities on the stream are Olean, New York and Oil City, Warren, and Franklin, Pennsylvania. Olean and Franklin have recently completed primary sewage treatment plants and the remaining large communities have taken steps toward treatment. Warren, Oil City, Ford City and Kittanning, Pennsylvania are building or have completed interceptors and a number of smaller municipalities have made similar progress.

Laboratory data indicate the need for more complete treatment at Olean if the stream is to be maintained in good condition at all times. At Coudersport, Pennsylvania, near the source of the Allegheny, secondary treatment is indicated. Primary treatment of sewage and organic industrial wastes should be adequate at other sources of pollution on this stretch of the Allegheny.

Clarion River - This stream and its tributaries receive wastes with a population equivalent of 147,000, of which more than 80 percent is from a pulp and paper mill and several tanneries located in the upper part of the drainage area. In the past, downstream water plants on the Allegheny have experienced taste, odor and color troubles, apparently due to these industrial wastes, at times when a rapid drawdown at Piney Reservoir coincided with a low-flow period on the Allegheny. An understanding with the power company which operates the Piney project, regarding rapid release of water, together with improvements in waste disposal methods at the industrial plants, have improved conditions at downstream water plants in recent years..

The Clarion River itself is still grossly polluted, however, Local oxygen depletion is common during the warm months as far downstream as Piney Dam. Although the stream was found to have a good plankton and fish population at the time of the laboratory survey, the fish are said to be inedible because of the obnoxious taste of the flesh.

All of the industries have taken steps to reduce pollution and the pulp and paper plant has spent large sums on treatment of its wastes. Continued intensive research leading to the development of better methods of disposal is not only amply justified but essential if the Clarion River is to be restored.

From the standpoint of its effect on the quality of the water in the Allegheny, the proposed flood control and power project on the Clarion, which has been studied by the U. S. Engineer Department, does not seem desirable as an initial development. Although low-flow regulation by the reservoir would be valuable for neutralization of acidity in the lower Allegheny and upper Ohio Rivers, the possible deleterious effects of the polluted water at times of low flow in the Allegheny would more than outweigh the beneficial effects. Further reduction in the pollution of the Clarion River and low-flow regulation by other reservoirs which would reduce the proportion of the Allegheny flow contributed by the Clarion would make the proposed reservoir more desirable.

Other Tributaries - Most of these streams are relatively clean. Mahoning Creek, Crooked Creek and Cowanshannock Creek are affected by acid mine drainage. Considerable progress has been made toward pollution abatement in streams not affected by acid. A program for the treatment of all wastes discharged to French Creek and its tributaries is nearing completion. Serious local nuisances still occur below Bradford, Corry, DuBois, Kane and a few other communities.

Secondary treatment is indicated at these places. Primary treatment should be sufficient at a number of other communities where pollution is less severe.

At Jamestown and Falconer, New York, the Chadakain River and Cassadago Creek are rather heavily polluted by textile wastes and municipal sewage. The cities have constructed primary treatment plants but most of the industrial wastes are discharged directly to the Chadakain River. Either secondary waste treatment or low-flow regulation from storage in Lake Chautauqua is indicated to improve conditions.

Cost - Estimates of the cost of existing sewage treatment facilities and of a suggested pollution abatement program are shown in Table A-1.

TABLE A-7 ALLEGHENY RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth		Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml.	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
						p.p.m.	% Sat.						
Allegheny River at city limits, Pt. Allegh.	A	285.5	Aug.23	11	15.5	7.3	72.5	1.0	4	7.0		35	
"	"	"	" .28	82	15.0	8.0	79.2	2.3	110	7.0			
"	"	"	" 30	30	17.5	8.3	86.1	1.1	9	7.1			
Allegheny River 1¼ mi. below Pt. Allegheny, Pa	A	283.5	Aug.23	18	16.0	5.2	52.1	2.9	2,400	7.0		35	
"	"	"	" 28	106	14.5	8.1	78.8	2.9	2,400	7.0	15		44
"	"	"	" 30	44	17.0	8.2	84.0	0.4	36	7.2			32
Marvin Creek, W. City limits, Smethport, Pa.	ApoM	289.8	Aug.28	21	14.0	9.1	87.4	1.2	150	7.0	13	24	46
"	"	"	" 30	7	17.5	8.1	83.7	1.3	93	7.1			44
Potato Creek 1-3/4 mi. above Smethport, Pa.	APo	291	Aug.23	6	15.0	8.1	79.7	0.7	9	7.1		26	
"	"	"	" 28	22	14.0	9.2	88.3	0.6	240	7.0			
"	"	"	" 30	28	17.5	6.7	69.2	1.4	240	7.1			
Potato Cr. 2 mi. below Smethport, Pa.	APo	286	Aug.23	14	16.5	6.0	61.4	2.0	23	7.0	10	29	54
"	"	"	" 28	65	14.5	8.2	79.8	2.4	1,100	7.1			
"	"	"	" 30	28	17.5	6.7	69.2	1.4	240	7.1			
Potato Cr. 1 mi. above mouth	APo	279	Aug.28	83	15.0	6.2	60.6	10.4	240	7.0	400	36	42
"	"	"	" 30	55	18.0	6.5	67.8	1.1	93	7.1	3		84
Allegheny R. 3 mi. above Eldred, Pa.	A	276	Aug.23	33	16.0	6.4	64.3	1.1	9	7.2	10	39	
"	"	"	" 27	34	13.5	7.4	71.1	0.7	4	7.1			
"	"	"	" 29	179	16.0	7.8	78.2	1.4	150	7.1			
Allegheny R. 1½ mi. below Eldred, Pa.	A	269.5	Aug.23	44	16.0	8.0	80.2	1.9	240	7.1		38	66
"	"	"	" 27	48	13.5	7.9	75.7	1.8	240	7.0			
"	"	"	" 29	287	15.5	6.7	66.8	3.5	460	7.1			
Tram Hollow Run ½ mi. above Duke Center, Pa.	AKnT	276	Aug.23	**	15.5	7.4	73.1	0.9	24	7.4	7	120	272
"	"	"	" 27	1	12.0	7.7	71.2	2.2	24	7.4	3		256
"	"	"	" 29	**	15.0	8.1	79.5	1.5	240	7.4	8		284
Knapp Cr. ½ mi. above Duke Center, Pa.	AKn	276	Aug.23	1	14.5	8.2	79.6	1.3	24	7.6			
"	"	"	" 27	1	12.0	8.8	81.3	1.1	24	7.5			
"	"	"	" 29	1	15.0	8.4	83.0	1.9	24	7.4			
Knapp Creek below Duke Center, Pa.	AKn	274.5	Aug.23	2	15.0	5.6	55.3	1.7	460	7.3	2	114	284
"	"	"	" 27	2	12.5	6.9	64.5	1.1	240	7.3	5		268
"	"	"	" 29	3	15.0	7.6	75.3	1.2	240	7.3	5		296
Oswago Cr. 1 mi. above Shinglehouse, Pa.	AOs	276	Aug.19	15	20.5	7.2	79.6	1.9	24	7.0		33	
"	"	"	" 26	16	13.5	8.9	85.1	1.5	4	7.2			

TABLE A-7 ALLEGHENY RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth		Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml.	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
						p.p.m.	% Sat.						
Oswego Cr. 2 mi. below Shinglehouse, Pa.	AOs	271.5	Aug.19	28	20.0	7.2	78.7	2.3	110	7.0	10	44	56
"	"	"	" 26	24	13.0	8.8	83.1	1.0	460	7.1			
Genessee Cr. ½ mi. above Bolivar, N.Y.	AOsG	278	Aug.21	1	13.5	7.7	73.8	1.2	46	7.0		66	
"	"	"	" 26	1	12.0	7.0	64.5	1.0	46	7.0			
"	"	"	Sept.4	1	16.5	8.4	85.4	1.5	9	7.2			
Genessee Cr. 3 miles below Bolivar, N. Y.	AOsG	273.5	Aug.21	4	16.0	6.0	59.9	2.0	43	7.3	3	66	192
"	"	"	" 26	5	13.0	6.1	57.7	1.7	240	7.2	14		190
"	"	"	Sept.4	4	15.5	6.2	66.0	2.0	23	7.3	7		188
Oswego Cr. Nr. Route 16, Mill Grove, N.Y.	AOs	266	Aug.26	26	14.0	8.5	82.1	1.2	4	7.2	4	38	58
Allegheny R. ½ mi. above Portsville, N.Y	A	265	Aug.16	51	20.0	7.2	78.4	1.7	2	7.1		40	
"	"	"	" 19	53	19.5	6.3	67.6	1.8	46	7.0			
"	"	"	" 27	57	12.5	7.4	69.4	1.2	46	7.1			
Allegheny R. 2 mi. below Portsville, N.Y.	A	263	Aug.16	94	20.0	6.0	65.9	2.1	15	7.1		41	
"	"	"	" 19	97	20.0	6.0	65.4	2.2	46	7.0			
"	"	"	" 27	104	13.0	7.4	70.0	1.6	93	7.2	2		96
Allegheny R. 3 mi. above Olean, N. Y.	A	261	Aug.16	99	20.0	6.4	69.8	2.1	9	7.1		43	
"	"	"	" 19	105	20.0	6.1	66.2	2.7	4	7.0			
"	"	"	" 21	122	16.5	8.0	81.6	1.5	8	7.2			
Ischua Cr. 3/4 mi. above Franklinville, NY	A01I	282	Aug.21	12	10.0	9.0	79.5	1.5	24	7.5		131	
"	"	"	" 26	12	11.5	8.5	77.4	0.5	24	7.6			
"	"	"	Sept.4	8	15.5	7.7	77.0	1.8	9	7.6			
Ischua Cr. ½ mi. below Franklinville, N. Y.	A01I	280	Aug.21	15	13.0	7.4	70.3	4.2	4	7.4	8	107	114
"	"	"	" 26	19	12.5	7.6	75.7	2.8	2	7.4	8		118
"	"	"	Sept.4	19	17.0	7.0	72.1	12.4	24	7.4	3		124
Oil Creek, ½ mile above Cuba	A010	275	Aug.21	2	11.0	5.0	44.9	1.7	24	7.4		131	
"	"	"	" 26	1	12.0	5.9	54.5	2.3	23	7.4			
"	"	"	Sept.4	2	14.0	4.6	44.1	1.8	23	7.2			
Oil Creek 2 miles below Cuba, N. Y.	A010	272	Aug.21	6	11.5	5.2	47.0	2.9	1,100	7.1	10	98	104
"	"	"	" 26	6	12.5	4.4	41.2	2.5	430	7.2	5		108
"	"	"	Sept.4	19	14.5	6.6	64.5	2.9	430	7.2	10		102
Olean Cr. Olean Waterworks, Olean, N. Y.	A01	261.5	Aug.16	34	21.0	7.1	78.8	2.3	4	7.4	14	41	
"	"	"	" 19	36	19.5	6.8	73.3	2.1	4	7.4	3		94
"	"	"	Sept.3	62	18.0	9.2	96.4	1.6	24	7.4	6		88
"	"	"	" 4	55	18.0	8.7	91.6	1.6	9	7.5	16		
Allegheny R. 1 mile below Olean, N. Y.	A	256.5	Aug.16	113	19.0	2.2	23.9	4.3	15	7.1		77	
"	"	"	" 19	118	20.0	1.0	11.0	6.4	240	7.0			90
"	"	"	" 21	142	17.0	8.6	88.8	2.8	23	7.3			88

TABLE A-7 ALLEGHENY RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth		Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
						p.p.m.	% Sat.						
Allegheny R. ½ mi. above Allegheny, N.Y.	A	254.5	Aug.16	130		2.6		4.1	43	7.1		72	
"	"	"	" 20	143	16.0	4.0	40.4	2.4	23	7.1			
"	"	"	" 22	131	14.5	5.0	48.6	2.8	15	7.1			
Allegheny R. ½ mile below Allegheny, N.Y.	A	253.5	Aug.16	159	19.5	4.7	50.6	2.5	93	7.1		69	82
"	"	"	" 20	166	17.0	3.9	40.4	2.8	43	7.1			76
"	"	"	" 22	148	15.0	4.9	48.7	2.0	9	7.0	3		98
Tunungwant Cr. 1 mi. above Bradford, Pa.	ATu	254.5	Aug.22	2	14.0	9.4	90.8	1.5	15	7.2		42	
"	"	"	" 27	2	13.0	9.0	85.4	1.6	24	7.2			
"	"	"	" 29	8	15.5	9.1	90.9	1.0	9	7.1			
E.Br.Tunungwant Cr. 1 mi.abv.Bradford,Pa.	ATuEb	255	Aug.22	8	14.0	8.8	84.8	2.2	9	7.2	5	53	312
"	"	"	" 27	8	13.0	8.7	82.3	1.6	240	7.2	8		254
"	"	"	" 29	24	16.0	8.5	85.8	2.4	93	7.2	7		304
Tunungwant Cr. 1½ mi. below Bradford, Pa.	ATu	249.5	Aug. 22	21	15.0	0.1	1.2	7.9	4,600	7.1	21	82	254
"	"	"	" 27	21	15.0	1.2	11.5	5.0	930	7.2	13		260
"	"	"	" 29	58	17.0	4.6	46.7	1.9	1,500	7.1	11		244
Tunungwant Cr. 2 mi. above mouth, IrvineMills	ATu	246	Aug.28	101	15.5	4.0	40.0	10.6	2,400	6.9	220	30	144
"	"	"	" 30	64	16.5	2.4	24.7	1.3	240	7.0	7		192
Allegheny R. 1 mi. above Salamanca, N. Y.	A	236.5	Aug. 20	317	16.5	6.0	60.4	2.4	4	7.1		74	
"	"	"	" 29	991	17.5	7.1	73.9	3.7	460	7.2			
"	"	"	Sept. 3	600	18.0	6.8	71.0	1.6	4	7.2			
Great Valley Cr. 2 mi. above Ellicottville, NY	AGv	249	Aug.20	2	14.5	9.2	89.5	3.1	9	7.3		77	
"	"	"	Sept. 3	8	17.0	8.7	89.5	1.2	24	7.2			
"	"	"	" 4	8	16.5	7.5	76.0	1.5	8	7.0			
Great Valley Cr.2½ mi. below EllicottvilleNY	AGv	245.5	Aug. 20	3	15.5	9.4	93.6	1.3	24	7.3		82	
"	"	"	Sept. 3	14	15.5	8.6	85.6	0.7	15	7.2			
"	"	"	" 4	8	16.5	8.4	85.7	1.3	14	7.2	1		84
Great Valley Cr.1 mi. above Gr.Valley, N.Y.	AGv	243	Sept. 3	14	16.5	8.8	89.7	1.4	2,400	7.3			
Great Valley Cr. 2 mi. below Gr.Valley, N.Y.	AGv	241	Sept. 3	29	16.0	8.9	89.8	1.0	4	7.2			86
Great Valley Cr.2½ mi. above Salamanca, N.Y.	AGv	238	Aug. 20	7	15.5	9.7	96.3	1.6	9	7.4		85	96
"	"	"	" 22	6	12.0	8.7	80.0	1.9	9	7.4			80
"	"	"	Sept. 3	30	17.5	9.1	94.1	1.7	43	7.3			
Little Valley Cr. 2 mi. abv.L. Valley, N.Y.	ALv	243.5	Aug. 20	1	17.5	9.3	96.4	1.4	46	7.2		58	
"	"	"	" 22	**	11.5	7.5	68.5	2.2	24	7.1			
"	"	"	Sept. 3	1	17.5	9.1	94.7	1.1	4	7.3			

TABLE A-7 ALLEGHENY RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth		Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
						p.p.m.	% Sat						
Little Valley Cr. 2 mi. below L.Valley, N.Y.	ALv	240	Aug. 20	2	16.0	9.2	92.1	1.3	43	7.2	3	72	82
"	"	"	" 22	1	11.0	9.3	84.3	1.1	9	7.3	3		84
"	"	"	Sept. 3	1	14.7	9.5	92.8	1.3	9	7.3	9		60
Allegheny R. 3 mi. below Salamanca, N. Y.	A	228	Aug. 20	365	16.5	5.5	55.8	4.9	460	7.4		81	
"	"	"	" 29	1,140	17.0	6.6	68.1	1.3	43	7.4	19		100
"	"	"	Sept. 3	684	17.0	6.8	69.9	2.4	23	7.2	2		62
Cool Spring Cr. 2 mi. above Steamburg, N. Y	ACoS	226	Sept. 17	9	13.0	10.0	94.4	1.3	15	7.2		33	
"	"	"	" 23	2	15.5	9.6	95.2	0.9	9	7.2			
Cool Spring Cr. 1½ mi. below Steamburg, N.Y.	ACoS	223.5	Sept. 17	10	13.0	8.6	81.0	2.3	460	7.2	2	27	40
"	"	"	" 23	2	17.0	0.0	00.0	19.6	2,400	7.2	18		62
Kinzua Cr. 1 mi. above Mt. Jewett, Pa.	AKi	236	Aug. 28	8	14.5	9.4	91.5	1.1	9	6.9		17	
"	"	"	" 30	6	17.0	8.9	91.5	0.6	24	6.9			
Kinzua Cr. 3 mi. below Mt.Jewett, Pa.	AKi	231	Aug. 28	11	14.5	9.1	88.3	2.2	460	7.1	3	34	92
"	"	"	" 30	8	17.0	8.7	89.3	1.0	43	7.2	23		120
Hubert Run, 1 mi. above Kane, Pa.	AKiH	231.5	Sept. 9	1	14.5	9.3	90.5	1.7	24	6.3		9	
"	"	"	" 12	**	9.5	10.4	90.3	1.1	**	6.3			
"	"	"	" 19	**	12.0	10.3	95.5	1.0	**	7.1			
Hubert Run, ½ mile below Kane, Pa.	AKiH	229	Sept. 9	3	15.0	5.1	50.3	38.3	11,000	6.9	32	56	76
"	"	"	" 12	2	12.0	0.6	5.4	70.0	110,000	6.8	34		78
"	"	"	" 19	2	14.0	0.0	00.0	100.0	240,000	7.2	16		56
Kinzua Cr. Br. on Rt. 219, at mouth	AKi	203	Sept. 12	46	12.5	10.6	98.5	1.1	4	7.2	8	31	38
"	"	"	" 19	34	16.5	10.2	103.7	2.6	1	7.0	2		40
Allegheny R. Br. on US 6, Warren, Pa.	A	194	Sept. 10	755	17.5	8.0	82.5	1.3	4	7.2		45	
"	"	"	" 16	670	15.0	8.9	87.6	1.2	1	7.4			
"	"	"	" 20	550	16.0	8.8	88.2	0.9	1	7.2			
Little Conewango Cr. Br.Rt.17, abv Randolph	ACoLc	225	Sept. 11	40	12.5	7.6	71.3	1.8	46	7.2		72	
"	"	"	" 17	40	12.5	8.2	76.5	1.1	43	7.2			
"	"	"	" 23	28	14.5	7.4	72.1	1.2	240	7.3			
Little Conewango Cr. 1½ mi.bel.Randolph, NY	ACoLc	223	Sept. 11	42	13.0	7.5	71.0	1.6	23	7.2	13	75	78
"	"	"	" 17	40	13.0	8.0	75.6	1.4	21	7.2	18		50
"	"	"	" 23	37	15.5	7.1	70.5	0.9	39	7.2	4		84
Lake Chautauqua, Celeron Park, Celeron, N.Y	ACoChLc	225	Sept. 11		16.0	7.2	72.8	2.5	110	7.2		49	
"	"	"	" 17		16.5	9.5	96.8	2.0	4	8.7			
"	"	"	" 23		19.5	8.7	93.5	1.9	2	8.1			
Lake Chautauqua, City limits, Jamestown, N.Y.	ACoChLc	223	Sept. 11		15.5	8.3	82.7	2.2	4	7.8	8	42	50
"	"	"	" 17		16.0	10.8	108.1	2.5	43	8.7	3		50
"	"	"	" 23		19.0	10.5	112.2	2.1	24	8.2	3		58

TABLE A-7 ALLEGHENY RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
					p.p.m.	% Sat.						
Chadakoin R. Off Rt. 17 Falconer, N. Y.	ACoCh 218	Sept.11	164	15.5	7.9	78.8	3.8	110	7.2		46	
"	" "	" 17	332	16.0	9.1	91.9	2.7	240	7.3	18		54
"	" "	" 23	300	17.0	8.4	86.2	2.5	240	7.6			
Cassadaga Cr. Br. on Rt. 17, Levant, N. Y.	ACoCa 217	Sept.11	31	15.5	7.1	70.5	1.4	9	7.2	15	78	84
"	" "	" 17	30	14.5	7.8	76.4	1.2	2	7.2			
"	" "	" 23	26	17.0	7.1	73.0	0.9	4	7.2			
Cassadaga Cr. S.of Rt. 17, Levant, N. Y.	ACoCa 215.5	Sept.11	200	16.5	6.5	66.1	5.5	240	7.2		57	
"	" "	" 17	364	16.0	8.4	84.4	3.7	240	7.8	23		56
"	" "	" 23	326	18.5	7.9	83.8	3.2	93	7.4	7		62
Conewango Cr.5th St. Br. Warren, Pa.	ACo 193	Sept.10	600	16.5	7.3	74.2	3.0	75	7.2	42	45	52
"	" "	" 16	610	15.5	7.4	73.8	2.0	23	7.2	14		72
"	" "	" 20	400	14.5	8.5	82.6	2.4	460	7.2	17		72
Alleghany R. 4 mi. below Warren, Pa.	A 184.5	Sept. 10	1,340	17.0	7.3	75.4	2.7	150	7.2	38	42	58
"	" "	" 16	1,320	16.0	7.9	79.8	1.8	93	7.3	5		76
"	" "	" 20	1,090	14.0	11.1	107.2	1.8	15	7.6	7		70
Hare Cr. ½ mi. above Corry, Pa.	ABrH 210	Sept. 13	10	12.0	9.6	88.3	1.4	9	7.2		53	
"	" "	" 18	6	12.5	8.9	83.2	1.3	4	7.3			
"	" "	" 24	7	14.5	2.5	24.2	9.9	2,400	7.1			
Hare Cr. 1 mi. below Corry, Pa.	ABrH 208	Sept. 13	18	12.0	3.2	29.4	4.5	1,500	7.1	23	86	
"	" "	" 18	8	11.5	0.6	5.6	6.9	2,400	7.1			
"	" "	" 24	7	14.5	2.5	24.2	9.9	2,400	7.1			
Hare Cr. 3 mi. below Corry, Pa.	ABrH 206	Sept. 13	18	12.5	0.6	6.0	7.4	230	7.0		99	92
"	" "	" 18	8	14.0	0.0	00.0	22.6	4,300	7.2	14		100
"	" "	" 24	7	15.5	0.0	00.0	19.8	110,000	7.2	15		100
Mathews Run, 2 mi. above Youngsville, Pa.	ABrM 188.5	Sept. 10	6	16.0	9.5	95.1	0.8	4	6.8	4	33	40
"	" "	" 16	3	14.0	9.9	95.1	0.7	4	7.2			34
"	" "	" 20	3	14.0	9.9	95.4	0.6	2	7.2			42
Brokenstraw Cr.1 mi. above Youngsville, Pa	ABr 189	Sept. 10	112	16.5	9.3	94.3	1.8	46	7.6		67	
"	" "	" 16	128	14.0	8.7	83.7	1.3	4	7.4			
"	" "	" 20	82	15.0	11.6	113.9	1.7	2	8.1			
Brokenstraw Cr. Br. Rt. 6, Youngsville, Pa.	ABr 187.5	Sept. 10	120	16.5	9.8	99.6	1.3	43	7.6	8	68	68
"	" "	" 16	132	14.5	7.3	70.7	1.2	9	7.4			
"	" "	" 20	85	15.5	11.6	115.8	1.2	2	7.7			
Brokenstrew Cr. Br. on US 6, Irvine, Pa.	ABr 184	Sept. 10		17.0	9.3	95.6	1.7	24	7.5		67	
"	" "	" 16	134	15.0	8.5	83.3	1.4	15	7.4	5		82
"	" "	" 20	87	15.0	11.8	116.0	3.8	15	8.2	4		76

TABLE A-7 ALLEGHENY RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
					p.p.m.	% Sat.						
West Run. city limite, Kane, Pa.	AT1EbW 207	Sept. 9	**	15.0	8.9	87.6	1.3	9	7.1		35	
"	" "	" 12	**	10.0	10.0	87.9	0.8	4	7.1			
"	" "	" 19	**	11.5	9.4	85.9	0.9	2	6.9			
West Run 2 miles below Kane, Pa.	AT1EbW 205	Sept. 9	6	15.0	7.1	70.0	3.9	240	6.5	12	20	50
"	" "	" 12	4	10.0	8.3	73.1	3.2	43	7.0	2		46
"	" "	" 19	3	11.0	7.1	64.2	3.2	15	6.8	1		
Two Mile Run, 1½ mi. above Ludlow, Pa.	AT1T 200	Sept. 9	11	14.0	9.5	91.8	1.2	46	7.0		17	
"	" "	" 12	8	9.5	10.6	92.4	1.6	9	7.1			
"	" "	" 19	8	10.5	10.5	94.0	0.9	4	7.1			
Two Mile Run, 1 mile elow Ludlow, Pa.	AT1T 198.5	Sept. 9	17	14.5	8.9	86.8	2.0	240	7.0	16	19	34
"	" "	" 12	10	10.0	9.2	81.6	3.0	1,100	7.1	7		36
"	" "	" 19	8	11.0	9.1	82.1	2.3	460	7.2	4		40
Two Mile Run, at mouth Sheffield, Pa.	AT1T 194	Sept. 10	40	15.0	8.4	82.9	2.0	460	6.6	11	28	76
"	" "	" 16	16	13.5	10.0	95.4	2.7	240	7.1	3		28
"	" "	" 20	12	14.0	9.1	87.7	2.1	4,600	6.3			32
Tionesta Cr. 1 mi. above Sheffield, Pa.	AT1 194	Sept. 10	65	15.5	7.6	75.4	1.7	46	6.4		21	
"	" "	" 16	26	14.0	9.3	89.8	1.0	8	7.0			
"	" "	" 20	25	14.0	8.7	83.8	1.4	24	7.0			
Tionesta Cr. 1½ mi. below Sheffield, Pa.	AT1 192.5	Sept. 10	108	15.0	8.1	79.7	2.1	240	6.6	23	22	28
"	" "	" 16	44	14.0	9.7	93.4	1.9	1,100	7.0	9		24
"	" "	" 20	37	14.5	8.6	83.3	2.1	240	6.9	10		30
Allegheny R. State St. Bridge, Oil City, Pa.	A 134.2	Oct. 3	1,550	15.0	9.3	91.9	0.3	**	7.4		47	
"	" "	" 15	1,160	13.5	9.5	91.0	1.5	9	7.4			
"	" "	" 24	1,110	8.0	11.4	96.4	1.2	4	7.3			
Oil Cr. 1 mi. above Titusville, Pa.	AO1 153	Oct. 3	8	13.0	10.9	102.7	1.4	4	7.5			73
"	" "	" 15	8	12.0	9.5	87.4	2.0	8	7.4			
"	" "	" 24	9	8.0	11.9	100.1	0.8	**	7.6			
Oil Creek, ¾ mi. below Titusville, Pa.	AO1 149	Oct. 3	8	13.0	11.3	106.9	1.1	43	7.8			78
"	" "	" 15	12	11.5	8.8	80.4	2.6	75	7.3			
"	" "	" 24	10	8.0	10.8	91.1	0.9	7	7.5			
Oil Creek, ½ mi. above Rouseville, Pa.	AO1 139	Oct. 3	55	13.0	10.5	99.2	0.7	**	7.5		45	
"	" "	" 15	71	13.0	8.3	77.9	2.1	4	7.3			
"	" "	" 24	78	9.0	9.9	85.2	1.4	1	7.4			
Oil Creek ¾ mile below Rouseville, Pa.	AO1 138	Oct. 3	58	15.0	8.4	82.7	3.7	43	7.8		73	
"	" "	" 15	74	14.5	7.1	68.9	5.3	460	7.2			
"	" "	" 24	80	9.5	8.0	69.9	3.3	3	7.4			

TABLE A-7 ALLEGHENY RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
					p.p.m.	% Sat.						
Oil Creek, Bridge Seneca Ave., Oil City, Pa.	AO1 135	Oc6. 3	59	18.5	5.0	53.1	3.5	240	7.4	7	71	102
"	" "	" 15	76	15.0	3.1	30.5	4.2	240	7.2	23		100
"	" "	" 24	82	10.0	4.4	38.8	1.7	9	7.3	8		108
Allegheny River, 2 mi. below Oil City, Pa.	A 132	Oct. 3	1,610	14.0	9.8	94.1	1.2	46	7.4	8	47	60
"	" "	" 15	1,240	13.0	9.4	88.3	1.7	43	7.3	5		74
"	" "	" 24	1,200	7.5	11.2	93.1	1.1	4	7.4	5		64
Allegheny R. 1 mi. above Franklin, Pa.	A 127	Oct. 7	1,350	17.0	8.7	89.7	1.6	46	7.4		29	
"	" "	" 16	1,340	9.5	9.1	79.3	0.5	43	7.2			
"	" "	" 25	1,270	9.0	10.2	87.9	1.4	93	7.4			
French Cr. above town Union City, Pa.	AFrSb 197	Sept.13	26	12.5	9.3	86.6	1.3	2	7.1		89	
"	" "	" 18	18	13.5	8.8	84.0	1.1	2	7.4			
"	" "	" 24	16	16.5	8.0	80.9	0.9	4	7.5			
French Cr. 1½ mi. below Union City, Pa.	AFrSb 195	Sept. 13	34	13.5	9.0	85.5	4.6	930	7.3	4	92	100
"	" "	" 18	21	14.0	8.6	83.3	1.6	230	7.2	2		88
"	" "	" 24	16	16.5	6.3	63.9	2.2	430	7.5	8		96
French Cr. Bridge U.S. 6, Cambridge Spgs. Pa	AFrSb 174	Sept. 13	129	14.5	8.8	85.9	0.9	2	7.4		87	
"	" "	" 18	79	15.5	9.2	91.3	1.4	4	7.4			
"	" "	" 24	75	18.5	8.6	91.3	0.9	8	7.5			
French Cr. 3 mi. below Cambridge Springs, Pa.	AFrSb 172	Sept. 13	170	14.0	9.7	93.9	1.3	9	7.5	13	85	84
"	" "	" 18	80	16.5	9.0	91.9	1.9	4	7.4	7		82
"	" "	" 24	76	18.5	7.6	80.2	1.6	2,400	7.4	23		92
Cussewago Cr. 3 miles above Meadville, Pa.	AFrC 158.5	Oct. 15	47	12.0	7.3	67.4	1.9	1	7.2	14		68
"	" "	" 24	36	10.0	6.9	60.5	2.1	1	7.2	2		80
French Creek, 3 miles above Meadville, Pa.	AFr 161.5	Oct. 3	114	15.5	10.7	106.3	0.8	4	7.9		85	
"	" "	" 15	124	12.5	9.4	87.8	1.2	9	7.4			
"	" "	" 24	128	11.5	8.5	77.7	7.6	**	7.4			
French Cr. 2 miles below Meadville, Pa.	AFr 152.5	Oct. 3	157	16.0	4.4	44.6	2.7	230	7.2	14	81	86
"	" "	" 15	171	14.0	1.7	16.7	6.4	240	7.2			102
"	" "	" 24	165	11.0	4.9	44.0	4.3	1,100	7.3	15		96
French Cr. 13th St. Br. Franklin, Pa.	AFr 128	Oct. 7	202	17.0	9.0	92.4	1.1	2	7.6	3	84	100
"	" "	" 16	211	9.0	9.8	84.4	1.4	4	7.4			84
"	" "	" 25	235	9.0	10.2	88.2	2.0	110	7.4	8		74
Allegheny River 1 mi. below Franklin, Pa.	AFr 124.5	Oct. 7	1,550	17.0	8.3	85.2	1.6	93	7.4	5	66	60
"	" "	" 16	1,550	9.0	9.4	80.8	1.5	23	7.2			72
"	" "	" 25	1,410	8.5	9.8	83.8	2.0	4	7.6	6		90

TABLE A-7 ALLEGHENY RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth		Date 1940	Average Discharge c. f. s.	Temp. °C.	Dissolved Oxygen		5 Day B. O. D. p. p. m.	Coliforms M. P. N. Per ml.	pH	Turbidity p. p. m.	Alkalinity p. p. m.	Hardness p. p. m.
						p. p. m.	% Sat.						
Lower Two Mile Run ½ mi.abv mou.Franklin,Pa	ALO	125.5	Oct. 16	3	5.5	12.2	96.5	1.2	4	7.2		130	170
Sulfur Run. Br. on Rt. 62, Stoneboro, Pa.	ASaS	135	Oct. 7	**	14.0	9.1	87.8	2.6	93	7.2		264	
"	"	"	" 16	**	6.5	11.6	93.8	1.2	2	7.9			
"	"	"	" 25	**	8.5	10.5	89.8	1.7	2	7.6			
Sulfur Run Br. near RR sta. Stoneboro, Pa.	ASaS	134.5	Oct. 7	**	15.0	5.4	53.2	24.0	46,000	7.8	45	210	244
"	"	"	" 16	1	7.0	9.8	80.4	3.7	1,500	7.5			292
"	"	"	" 25	1	8.5	8.3	70.9	5.2	4,300	7.9	14		324
Sandy Cr. Bridge Rt. 62 Sandy Lake, Pa.	ASa	133.5	Oct. 7	5	15.5	10.1	100.8	1.5	4	7.6		78	
Sandy Cr. 1 mi. below Sandy Lake, Pa.	ASa	132	Oct. 7	5	15.0	7.6	74.6	1.2	15	7.4		85	
"	"	"	" 16	5	7.0	8.7	71.7	1.1	9	7.2			104
Sandy Cr. Off Rt. 62 Polk, Pa.	ASa	123.5	Oct. 7	6	16.5	9.9	100.9	1.0	1	7.4		73	
"	"	"	" 16	5	6.5	11.7	95.2	1.4	1	7.4			
"	"	"	" 25	6	8.0	11.3	95.5	1.5	2	7.2			
Sandy Creek ½ mi. below Polk, Pa.	ASa	121	Oct. 7	10	16.0	9.1	91.8	1.2	150	7.3	3	68	102
"	"	"	" 16	10	7.0	11.4	93.7	1.3	4	7.2			
"	"	"	" 25	10	8.0	11.0	92.8	1.8	9	7.4	22		94
Little Sandy Cr. Br. Rt. 62, Polk, Pa.	ASaL	123.5	Oct. 7	4	16.0	9.6	96.4	3.3	9	7.3		53	58
"	"	"	" 16	4	7.5	11.2	93.6	3.7	**	7.2			60
"	"	"	" 25	4	8.5	10.3	87.6	4.3	**	7.5	10		64
Allegheny R. Bridge Rt. 38, Emlenton, Pa.	A	91.6	Oct. 10	1,740	11.0	9.9	89.0	1.2	**	7.3		55	
"	"	"	" 23	1,760	7.0	11.8	97.4	2.5	1	7.4			
Allegheny River 3 mi. below Emlenton, Pa.	A	87.8	Oct. 10	1,780	11.5	9.5	86.7	0.7	8	7.4		56	
"	"	"	" 23	1,790	7.0	11.9	98.0	1.4	2	7.4			
W. Br. Clarion R. ½ mi. above Wilcox, Pa.	AClWb	194.5	Sept. 9	26	15.5	9.5	94.3	1.7	240	7.0		22	
"	"	"	" 12	12	11.5	11.0	100.7	0.9	4	7.2			
"	"	"	" 19	10	13.0	10.4	97.7	1.5	9	7.1			
W. Br. Clarion R. 1 mi. below Wilcox, Pa.	AClWb	193	Sept. 9	59	15.5	8.5	84.3	3.5	240	7.2	35	24	88
"	"	"	" 12	26	12.0	10.4	96.3	3.0	150	7.7	5		94
"	"	"	" 19	19	12.5	9.8	91.4	2.5	93	7.4	7		82
W. Br. Clarion R. Bridge Rt.219, Johnsonburg, Pa.	AClWb	188	Sept. 30	21	11.0	10.2	92.5	5.9	110	7.2	4	31	74
"	"	"	Oct. 8	22	13.5	8.8	83.8	2.8	460	6.8	3		70
"	"	"	" 18	22	6.0	11.4	91.3	3.2	460	6.9			98
"	"	"	" 28	23	8.0	11.5	97.1	1.4	430	7.2			
"	"	"	" 30	20	7.5	11.8	98.3	1.8	93	7.2			
"	"	"	" 31	21	8.0	11.6	98.1	2.3	240	7.2			

TABLE A-7 ALLEGHENY RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
E.Br.Clarion R. 1st Ave. Br.Johnsonburg,Pa.	AC1Eb 188	Sept.30	40	30.5	4.1	53.8	5.2	240	7.2	5	39	50
"	" "	Oct. 8	36	13.0	8.1	76.8	1.7	93	6.9	3		46
"	" "	" 18	40	8.5	12.4	105.7	3.1	4	6.8			66
"	" "	" 28	29	6.0	11.8	95.0	1.8	4	7.2			
Clarion R. Bridge in town,Johnsonburg,Pa.	AC1 187	Sept. 30	61	21.0	0.0	00.0	159	210	7.3	65	122	
"	" "	Oct. 8	58	27.0	0.0	00.0	292	11,000	7.2			
"	" "	" 18	62	20.0	0.0	00.0	268	2,400	7.1			
"	" "	" 28	53	15.6	3.0	30.4	128	2,240	6.6			
"	" "	" 30	62	17.0	0.0	00.0	77.5	6,700	7.0			
"	" "	" 31	62	16.0	0.0	00.0	216	930	7.0			
Clarion R. 1 mi. below Johnsonburg, Pa.	AC1 186	Sept. 30	65	18.0	6.1	63.5	17.5	430	6.6		74	
"	" "	Oct. 8	60	14.5	0.0	00.0	74.4	11,000	6.9			
"	" "	" 18	63	9.5	0.0	00.0	117	2,400	7.0			
"	" "	" 28	54	10.3	4.7	[illegible]	43.5	5,850	3.5			
"	" "	Oct. 30	63	11.3	0.0	00.0	35.2	9,800	7.2			
"	" "	" 31	64	10.3	1.9	17.2	85.7	2,400	7.8			
Clarion R. City limits, Ridgeway, Pa.	AC1 182.5	Sept. 30	87	12.0	7.6	69.7	16.5	460	6.6		52	
"	" "	Oct. 8	80	15.5	5.2	51.2	27.5	11,000	7.0			
"	" "	" 18	74	8.0	0.6	4.6	99.8	4,300	7.1			
"	" "	. 28	74	7.5	0.0	00.0	2.8	2,400	7.2			
"	" "	" 30	87	7.5	0.0	00.0	8.4	930	7.2			
"	" "	" 31	88	8.5	3.7	31.7	59.2	4,600	7.3			
Elk Cr. Br. off Rt. 120 St. Mary's, Pa.	AC1E 193.5	Sept. 27	2	10.0	10.8	94.9	* 1.5 3.4	**	3.1			190
"	" "	Oct. 8	2	13.5	8.0	76.5	* 5.5 3.1	2	3.1			400
"	" "	" 18	2	8.0	9.8	82.5	* 4.1 5.8	**	3.1			450
Elk Cr. ½ mi. below St. Marys, Pa.	AC1E 190	Sept. 27	4	10.5	9.6	85.4	17.9	4,600	6.1	4	14	104
"	" "	Oct. 8	4	13.5	5.7	54.4	30.1	2,400	5.5			
"	" "	Oct. 18	5	7.0	4.6	37.9	72.6	7,500	6.2	190		
Elk Cr. at mouth, Ridgeway, Pa.	AC1E 181	Sept.30	24	10.0	10.3	90.6	1.1	46	6.3	2	4	36
" "	" "	Oct. 8	18	12.5	9.4	87.3	1.7	240	7.0	7		32
" "	" "	" 18	74	6.5	9.9	80.5	6.0	43	7.1	6		98
" "	" "	" 30	24	6.5	11.5	93.5	0.4	1,100	6.9	16		48
Clarion R. 1 mi. below Ridgeway, Pa.	AC1 179	Sept.30	112	14.0	6.6	63.9	13.0	430	7.2	16	67	
" "	" "	Oct. 8	98	14.0	6.3	60.8	8.0	1,500	7.2	18		98
" "	" "	Oct. 18	90	9.0	0.6	5.3	125.	4,300	7.4	38		350
" "	" "	Oct. 28	99	7.5	1.0	8.0	2.1	3,350	8.2			
" "	" "	" 30	110	7.0	3.4	28.3	9.3	2,400	7.4	48		324
" "	" "	" 31	111	9.0	4.9	42.2	84.4	3,500	7.4	65		276
Mill Creek, Rt. 368 at mouth	AC1M 178	Sept.30	6	12.5	9.7	90.1	1.0	2	7.0	16	18	
" "	" "	Oct. 8	7	13.0	9.6	90.4	1.5	4	7.0	7		32

TABLE A-7 ALLEGHENY RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Little Toby Cr. 1 mi. above Brockway, Pa.	AClToL 184.5	Sept.27	24	7.5	10.8	89.7	1.4* 1.1	**	3.2			
" "	" "	Oct. 9	18	7.5	10.2	16	3.0* 1.6	**	3.0	8		214
" "	" "	" 17	20	5.5	12.0	94.7	0.5* 1.3	**	3.1	15		260
Little Toby Cr. City limits, Brockway, Pa.	AClToL 182.5	Sept.27	30	7.5	10.6	88.1	1.1* 2.3	24	3.4	8		
" "	" "	Oct. 8	22	8.0	9.7	81.5	0.9* 0.7	**	3.0			
" "	" "	" 17	22	6.5	9.4	76.5	0.9* 1.2	**	3.1			228
Toby Cr. Bridge Route 949, at mouth	AClTo 174	Sept.30	26	11.0	10.6	95.2	0.4* 1.2	**	3.2	3		124
" "	" "	Oct. 9	26	7.0	11.4	93.9	1.1* 1.2	**	3.0	5		156
" "	" "	" 17	25	7.5	12.8	106.8	0.1* 0.7	**	3.2	8		130
Clarion River, above Portland Mills	ACl 173	Sept.30	142	13.0	5.1	48.4	12.2	21	6.1	35	16	158
" "	" "	Oct. 9	135	9.0	7.6	65.6	4.3* 2.7	43	4.7			134
" "	" "	" 17	126	8.0	4.5	37.6	58.8	240	6.5			
" "	" "	" 29	92	5.0	6.0	47.2	6.1	24	6.6			
" "	" "	Oct. 31	185	6.5	8.9	72.4	17.9	46	7.1			
Clarion R. Bridge in town, Arroyo, Pa.	ACl 168	Oct. 1	175	11.0	6.3	56.9	6.6	15	6.8		27	
" "	" "	" 9	157	10.5	4.8	42.4	24.1	240	6.6			
" "	" "	" 17	137	8.5	4.8	41.3	187	1,100	6.3			
" "	" "	" 29	98	6.0	6.1	48.6	8.8	93	6.8			
" "	" "	" 31	215	6.0	7.6	60.6	31.4	24	7.0			
Clarion R. Br. Rt.368, Millstone, Pa.	ACl 150	Oct. 1	196	11.5	6.6	60.5	6.2	24	7.1		29	
" "	" "	" 9	160	11.5	5.0	45.9	23.2	93	6.9			
" "	" "	" 17	150	9.0	6.1	52.5	48.4	9	6.8			
" "	" "	" 29	119	4.0	7.5	57.4	3.0	15	7.0			
" "	" "	" 31	245	6.0	8.5	67.9	18.4	46	6.9			
Clarion R. Bridge Rt. 890, Clarington, Pa.	ACl 144.5	Oct. 1	247	12.0	6.5	59.6	6.8	46	7.0		31	
" "	" "	" 9	181	11.5	5.5	50.1	15.8	240	7.0			
" "	" "	Oct. 17	163	8.5	6.7	57.0	38.0	23	6.9			
" "	" "	" 29	135	4.0	7.3	55.8	4.2	9	7.1			
" "	" "	Nov. 1	278	6.0	8.6	69.2	18.4	240	7.1			
Clarion R. Bridge Rt. 36, Cooksburg, Pa.	ACl 135	Oct. 1	286	13.0	7.2	67.9	7.5	46	7.1		28	
" "	" "	" 9	190	12.0	6.0	55.2	25.3	43	7.0			
" "	" "	" 17	176	23.0	7.2	83.1	13.7	23	7.0			82
" "	" "	" 29	147	4.0	7.8	59.5	7.1	2	7.2			
" "	" "	Nov. 1	298	6.0	8.8	70.2	6.8	46	7.0			
Clarion R. 1 mile above Cooksburg, Pa.	ACl 137	Nov. 1	300	6.5	8.8	71.4	7.0	46	7.0			
Clarion R. 3 mi. south of Scotch Hill, Pa.	ACl 132	Oct. 9	198	13.5	6.5	62.0	11.8	93	7.1			
" "	" "	" 29	152	4.5	8.2	62.9	2.8	4	7.2			76
" "	" "	Nov. 1	310	6.5	8.9	72.2	7.7	9	7.1			218

TABLE A-7 ALLEGHENY RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c. f. s.	Temp. °C.	Dissolved Oxygen p. p. m.	Dissolved Oxygen % Sat.	5 Day B. O. D. p. p. m.	Coliforms M. P. N. Per ml.	pH	Turbidity p. p. m.	Alkalinity p. p. m.	Hardness p. p. m.
Mill Cr. Piney Reservoir, Mill Creek, Pa.	AClMi 123	Oct. 1		15.0	5.6	55.2	4.1	43	7.2	7	39	94
Clarion River, Piney Res. Mill Cr, Pa.	ACl 122	Oct. 1		13.5	7.4	71.0	3.0	24	7.0		29	
Toby Cr. Bridge off Rt. 966, Clarion, Pa.	AClTob 118	Oct. 1		16.5	1.5	15.4	2.0	4	6.6	4	32	98
Clarion R. Bridge Rt. 966, Clarion, Pa.	ACl 112	Oct. 9		16.0	2.1	20.7	3.0	4	6.6	15		78
Clarion R. Bridge Rt. 378, Callensburg, Pa.	ACl 101	Oct. 1	263	15.5	8.5	84.3	1.0	8	7.1		32	
"	" "	" 23	233	10.0	8.6	75.5	1.9	1	7.1			
Clarion R. Bridge south of St. Petersburg, Pa.	ACl 90.5	Oct. 1	290	15.5	9.3	92.7	0.7	2	7.2	8	28	84
"	" "	" 10	248	10.5	9.7	86.9	1.7	4	7.2	2	32	90
"	" "	" 23	274	8.0	10.8	90.8	1.3	**	7.2	12		88
Allegheny R. Bridge Rt. 68, Parkers Landing, Pa	A 85	Oct. 10	2,020	11.0	10.1	91.4	1.1	4	7.3		54	
"	" "	" 23	2,070	7.0	11.3	92.6	1.6	2	7.4			
Allegheny R. Bridge Rt. 68, East Brady, Pa.	A 70.7	Oct. 10	2,100	13.0	9.7	91.2	1.0	1	7.4		42	
"	" "	" 23	2,180	8.5	11.8	100.7	1.3	4	7.4	9		78
Sandy Lick Creek above DuBois, Pa.	AReS 141.5	Sept. 27	24	13.5	10.7	101.7	0.6	15	6.4		80	
"	" "	Oct. 11	14	7.5	10.2	84.8	1.5	4	6.6			
Sandy Lick Creek, below DuBois, Pa.	AReS 138.5	Sept. 27	25	13.5	8.2	78.3	17.2	24,000	6.5	22	89	52
"	" "	Oct. 11	15	8.5	5.6	47.9	61.6	24,000	6.7			64
"	" "	" 21	16	6.5	6.0	48.9	35.0	46,000	7.1			
Falls Creek 1 mi. above Falls Creek, Pa.	AReSF 139	Sept. 27	2	11.5	10.8	98.4	1.6	4	6.5		17	
"	" "	Oct. 11	2	8.0	10.5	88.5	1.0	2	6.9			
Falls Creek, Bridge Rt. 830, Falls Creek, Pa.	AReSF 138	Sept. 27	10	11.5	11.0	100.6	1.3	4	6.4	20	20	24
"	" "	Oct. 11	6	8.0	10.1	84.8	2.7	110	6.9			32
Soldiers Run, 3/4 mi. above Reynoldsville, Pa.	AReSS 132	Oct. 2	**	8.5	10.5	89.5	2.0* 1.2	1	3.1	4		410
"	" "	Oct. 11	**	5.0	10.5	82.3	1.7* 1.5	**	3.0			520
Sandy Lick Cr. Bridge Rt. 322, Reynoldsville, Pa	AReS 131.5	Oct. 2	23	10.5	7.7	68.4	1.5	9	6.5		26	
"	" "	" 11	19	6.0	8.8	70.9	1.8	15	6.5			
Sandy Lick Cr. City limits, Reynoldsville, Pa.	AReS 130	Oct. 2	24	10.5	7.2	64.2	2.2	4	6.2	3	21	86
"	" "	" 11	20	8.0	7.0	59.3	2.0	9	6.3			72
Sandy Lick Creek, city limits, Brookville, Pa.	AReS 115.5	Oct. 4	39	12.0	9.5	88.0	1.0	**	6.4	6	12	124
"	" "	Oct. 14	35	9.5	9.9	86.2	0.9	1	6.9	5		88

TABLE A-7 ALLEGHENY RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml.	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
					p.p.m.	% Sat.						
N.Fk.RedBank Creek, Br. Rt. 322, Brookville, Pa.	AReNf 113.5	Oct. 4	6	11.5	10.0	0.3	90.8	4	7.2	10	60	66
"	" "	" 14	7	8.0	10.2	1.1	85.8	1	7.3	10		28
Red Bank Cr. City limits, Brookville, Pa.	ARe 112	Oct. 4	46	12.0	9.7	1.7	89.9	2,400	7.2		25	
"	" "	" 14	42	8.5	9.6	1.6	82.1	430	7.0	3		
"	" "	" 22	31	7.0	15.3	2.6	125.7	430	7.4			
Red Bank Cr. ½ mi. abv. Summerville, Pa.	ARe 103	Oct. 4	55	10.0	10.6	0.9	93.6	4	7.2		22	
"	" "	" 14	50	9.0	10.0	1.0	86.5	.2	7.1			
"	" "	" 22	52	6.0	13.5	1.7	108.1	4	7.3			
Red Bank Cr. City limits, Summerville, Pa.	ARe 101.5	Oct. 4	55	10.5	11.0	0.6	98.5	23	7.2	14	23	74
"	" "	" 14	50	8.5	10.2	1.0	87.2	46	7.1			
"	" "	" 22	52	4.0	14.5	2.4	110.5	240	7.3			
Red Bank Cr. 1½ mi. above New Bethlehem, Pa.	ARe 87.5	Oct. 14	58	10.0	10.2	0.7	90.4	1	6.9		66	
"	" "	" 22	59	4.5	13.0	1.4	100.0	1	7.1			
Red Bank Creek, ½ mile below New Bethlehem, Pa.	ARe 86.5	Oct. 14	59	11.5	10.6	97.0	1.1	93	7.0		64	
"	" "	" 22	62	4.5	12.8	98.9	2.3	93	6.9			70
Red Bank Cr. 3 mi. sou. of Lawsonham, Pa.	ARe 70.5	Oct. 10	49	11.0	11.5	103.9	0.5	2	7.2		21	68
"	" "	" 14	64	11.5	10.9	99.1	1.4	**	6.9	3		82
"	" "	" 23	76	8.0	12.6	106.3	0.7	**	7.1	15		80
Allegheny River, Lock No. 9	A 62.2	Oct. 10	2,150	16.0	8.9	89.3	0.6	2	7.3	7	49	78
Sugar Camp Run, off Rt. 119, Sykesville, Pa.	AMaStS 127.5	Oct. 11	1	10.0	6.3	55.4	0.7* 3.9	**	6.3			368
"	" "	" 21	2	10.0	6.5	57.5	1.0* 5.8	**	6.2			388
Stump Creek, Sykesville, Pa.	AMaSt 127.5	Oct. 11	6	7.0	5.8	47.8	3.9	**	6.4			
"	" "	" 21	5	6.0	11.6	93.2	1.0* 6.2	**	5.8			260
Stump Creek, 1 mi. below Sykesville, Pa.	AMaSt 126	Oct. 2	8	9.0	3.2	27.8	0.0	**	6.1	150	21	420
"	" "	" 11	8	6.5	5.8	25.0	0.2	**	6.6			184
"	" "	" 21	7	6.0	12.1	97.1	1.4* 4.2	**	6.1	38		204
Stump Cr. Bridge off Rt. 951, Sykesville, Pa.	AMaSt 125	Oct. 2	1	8.0	10.8	91.0	1.1	.2	7.2	14	33	38
Stump Cr. 3 mi. below Sykesville, Pa.	AMaSt 124	Oct. 2	9	9.5	11.0	96.0	1.4* 3.7	**	3.2	58		520
Mahoning Cr. 1 mi. above Punxsatawney, Pa.	AMa 113	Oct. 2	33	11.0	10.4	94.1	0.8* 1.3	1	4.5			270
"	" "	" 10	44	13.5	10.2	97.6	2.4* 0.8	**	4.8			114
"	" "	" 22	27	7.0	12.5	102.8	2.2* 1.7	**	5.5			190
Mahoning Creek, Bridge Rt. 119, Punxsatawney, Pa.	AMa 109	Oct. 2	36	11.0	10.5	94.5	1.6* 0.9	**	5.2	34		230
"	" "	" 10	57	13.5	10.7	102.2	1.1	1	6.4	15		
"	" "	" 22	31	7.0	12.0	98.8	1.4	24	6.5			

TABLE A-7 ALLEGHENY RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth		Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml.	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
						p.p.m.	% Sat.						
Mahoning Creek 7 mi. above mouth	AMa	63	Oct. 22	49	3.5	13.0	98.0	0.1	**	6.4			178
Mahoning Creek at mouth	AMa	56.5	Oct. 10		16.0	9.4	94.2	1.1	**	7.3	23	45	56
Allegheny R. Lock and Dam No. 8	A	52.6	Aug. 20	830	25.5	8.1	97.6	1.4	4	7.4		56	
"	"	"	" 28	1,990	21.5	8.6	96.7	1.2		7.4		55	
"	"	"	Sept.12	4,040	20.0	9.0	97.9	1.5	4	7.3		49	
"	"	"	" 20	2,680	18.5	8.7	91.9	1.6	7	7.3		51	
"	"	"	" 23	2,580	19.5	8.6	92.7	2.1	1	7.3		50	
"	"	"	Oct. 3	2,610	15.0	9.8	96.5	1.4	9	7.5		50	
"	"	"	" 7	2,170	16.5	9.4	95.7	1.9	2	7.3		43	
"	"	"	" 16	1,800	14.5	9.9	96.5	1.2	4	7.5		48	
"	"	"	" 21	1,800	11.5	10.4	95.3	1.5	2	7.4		59	
"	"	"	" 31	2,200	9.0	11.2	96.5	1.5	3	7.3		60	
"	"	"	Nov. 5	7,400	9.0	12.1	104.2	1.7	4	7.3		50	
"	"	"	" 22	11,000	4.0	13.5	103.1	0.9	24	7.1		39	
"	"	"	" 25	12,400	6.0	13.2	105.4	1.4	15	7.2		33	
"	"	"	Dec. 6	11,700	0.0	14.6	99.7	1.3	46	7.1		26	
"	"	"	" 11	27,800	1.0	14.1	99.2	3.0	100	6.9		23	
Craig Run at mouth Rural Valley, Pa.	ACoC	62.5	Sept.10	**	15.0	7.8	76.8	1.6* 3.7	**	3.1	70		610
"	"	"	Oct. 24	**	10.0	7.4	64.9	3.4* 4.7	**	2.8	6		625
"	"	"	Nov. 14	6	9.0	9.3	80.1	1.0* 5.4	**	3.3	78		638
Cowanshannock Cr., Upper edge Rural Valley, Pa.	ACo	63	Sept.10	3	16.5	6.9	69.7	2.0* 4.3	**	2.9			
"	"	"	Oct. 24	1	11.0	8.8	79.0	1.0* 2.6	**	2.8			
"	"	"	Nov. 14	9	4.5	11.7	90.1	1.0* 2.3	**	3.3			
Cowanshannock Cr. 1/2 mi. below Yatesboro, Pa.	ACo	60	Sept.10	5	17.5	5.4	56.5	1.0* 2.5	**	3.2	68		365
"	"	"	Oct. 24	2	11.5	6.4	58.1	2.1* 4.5	**	2.9	60		524
"	"	"	Nov. 14	16	5.5	10.9	85.9	0.7* 3.8	4	3.5	22		320
Allegheny River, Lock & Dam #7, Kittanning, Pa.	A	45.7	Aug. 20	1,750	25.0	7.8	93.3	1.1	4	7.3		51	
"	"	"	" 28	2,030	21.0	8.3	92.0	0.7	4	7.3		52	
"	"	"	Sept.12	4,670	20.0	8.7	95.3	1.8	4	7.3		53	
"	"	"	" 20	2,860	18.5	8.6	91.5	1.0	2	7.5		52	
"	"	"	" 23	2,490	19.5	8.4	90.8	1.0	2	7.2		45	
"	"	"	Oct. 3	2,880	15.0	9.7	95.8	1.5	2	7.4		49	
"	"	"	" 7	2,490	16.5	9.6	97.1	1.5	1	7.4		45	
"	"	"	" 16	2,080	14.5	9.6	93.2	1.2	**	7.5		46	
"	"	"	" 21	2,080	11.0	10.4	93.5	1.3	1	7.2		48	
"	"	"	" 31	2,350	8.5	11.2	95.1	1.6	4	7.3		59	
"	"	"	Nov. 5	7,500	9.0	11.7	100.8	1.7	6	7.2		48	
"	"	"	" 22	11,200	4.0	13.5	102.7	1.1	4	7.3		37	
"	"	"	" 25	12,600	6.0	12.8	102.3	1.4	15	7.3		39	
"	"	"	Dec. 6	11,900	0.0	14.9	101.7	1.4	110	7.2		33	
"	"	"	" 11	28,300	1.0	14.2	99.8	2.2	24	6.9		25	

TABLE A-7 ALLEGHENY RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C.	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per n	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
					p.p.m.	% Sat.						
N. Br. Plum Cr., upper edge Sagamore, Pa.	ACrPlNb 78	Sept. 10	3	19.0	7.0	74.3	0.9* 1.4	2	3.2			
"	" "	Oct. 24	1	9.5	9.9	86.4	0.5* 1.4	**	2.9			
"	" "	Nov. 14	5	5.0	11.6	90.3	1.3* 1.5	**	4.0			
N. Br. Plum Cr. 3/4 mi. below Sagamore, Pa.	ACrPlNb 77	Sept. 10	4	17.0	7.4	76.0	0.6* 2.3	110	3.2	45		145
"	" "	Oct. 24	1	10.0	7.3	64.7	0.9* 4.9	**	3.6	14		316
"	" "	Nov. 14	5	5.5	11.2	88.8	0.9* 2.5	**	3.9	6		152
Crooked Cr. Crooked Cr. Res. Above Dam (10' depth)	ACr 49	Nov. 7		9.0	9.7	83.3	1.3	2	6.9	6	18	126
" (35' depth)	" "	" "		8.5	9.7	82.4	1.0	4	7.0	15	18	140
Crooked Cr. Reservoir above Dam	ACr 49	Oct. 24	12				1.3		6.9		8	
Crooked Cr. Reservoir below dam	ACr 46	Oct. 24	5				1.2		7.1	3	21	109
Allegheny R. Lock & Dam #5, Freeport, Pa.	A 30.4	Aug. 20	1,830	25.0	7.2	86.4	0.7	4	6.7		35	
"	" "	" 28	2,120	21.5	7.5	84.5	0.9	24	7.2		52	
"	" "	Sept. 12	4,920	20.0	8.2	89.1	1.2	43	7.3		54	
"	" "	" 20	3,020	19.5	7.4	79.4	1.4	23	7.3		45	
"	" "	" 23	2,120	20.0	7.8	85.0	1.2	25	7.3		52	
"	" "	Oct. 3	3,050	16.0	9.1	91.2	1.1	23	7.5		52	
"	" "	" 7	3,010	16.5	9.2	93.2	1.6	9	7.4		50	
"	" "	" 16	2,200	14.5	9.0	87.9	3.8	46	7.3		46	
"	" "	" 21	2,200	12.0	9.4	87.2	2.0	9	7.3		45	
"	" "	" 31	2,450	11.0	10.2	91.8	1.4	46	7.3		60	
"	" "	Nov. 5	7,600	9.5	10.8	94.6	1.6	110	7.3		56	
"	" "	" 22	11,200	4.0	12.7	96.4	1.1	25	7.3		37	
"	" "	" 25	13,000	6.0	12.4	99.6	1.1	24	7.4		37	
"	" "	Dec. 6	12,200	0.0	14.4	98.8	1.5	110	7.3		32	
"	" "	" 11	30,700	1.0	14.7	103.4	2.5	46	6.9		24	
Conemaugh R. below all sewage, Cresson, Pa.	AKiCo 141	July 19	**	15.0	8.3	81.6	1.9	75	7.3		69	
"	" "	" 31	**	16.5	7.1	72.5	2.7	460	7.2		86	
"	" "	Aug. 8	**	17.0	6.4	66.1	4.6	240	7.3		97	
Conemaugh R. Upper edge of Lilley, Pa.	AKiCo 136.5	July 19	1	17.5	7.5	78.0	1.3* 1.5	**	3.5			
"	" "	" 31	1	19.0	5.6	60.4	0.4* 1.1	15	3.4			
"	" "	Aug. 8	1	21.5	5.0	56.5	6.6* 6.3	9	4.1			
Conemaugh River, ½ mi. below all Sew. Lilly, Pa.	AKiCo 135.5	July 19	4	19.0	8.6	92.0	1.4* 2.3	9	3.1			
"	" "	July 31	3	18.5	7.6	80,8	0.6* 0.8	1	3.1			
"	" "	Aug. 8	2	23.5	6.1	70.7	2.0* 2.4	4	3.3			
Conemaugh R. Upper edge of Portage, Pa.	AKiCo 131	July 19	12	20.0	8.6	94.3	0.3* 0.7	**	3.1			
"	" "	" 31	11	18.5	8.5	89.7	0.5* 0.5	**	2.9			
"	" "	Aug. 8	10	22.5	8.0	91.0	0.5* 1,1	**	3.0			

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
					p.p.m.	% Sat.						
Trout Run at mouth Portage, Pa.	AKiCoT 129	July 19	2	19.0	7.8	83.9	1.7* 1.9	**	2.6	20		
"	" "	" 31	1	21.0	8.0	89.1	1.9* 1.8	**	2.7	12		
"	" "	Aug. 6	1	26.5	7.1	86.7	2.7* 6.0	**	2.7	4		
Conemaugh R. below town Portage, Pa.	AKiCo 128.5	July 19	14	19.5	8.5	91.4	1.0* 1.5	9	3.2	32		
"	" "	" 31	12	18.5	8.1	86.2	0.6* 0.8	**	2.9	54		
"	" "	Aug. 8	13	22.0	7.7	87.0	0.9* 1.9	1	3.0			
N. Fk. Conemaugh R. 100 yds.below Ebensburg,Pa.	AKiCoNf 137.5	July 19	2	17.0	7.2	74.2	6.8	93	7.0		60	
"	" "	" 31	2	20.0	7.1	77.5	1.4	240	7.3		59	
"	" "	Aug. 8	2	19.0	4.2	45.2	51.4	24,000	7.1		105	
N.Fk.Conemaugh R. at mouth, Wilmore, Pa.	AKiCoNf 127	July 19	5	26.5	10.5	129.2	1.2	4	7.5	4	39	53
"	" "	" 31	2	24.0	8.2	96.5	0.9	24	7.3	4	53	57
"	" "	Aug. 8	2	27.0	10.0	123.5	1.3	24	7.5	8	63	61
Conemaugh River, above South Fork, Pa.	AKiCo 123	July 22	33	19.5	7.8	83.8	1.7* 5.5	**	2.7			
"	" "	" 30	26	22.5	7.3	83.3	0.4* 0.7	2	3.1			
"	" "	Aug. 7	33	20.5	7.3	80.1	0.5* 1.0	**	2.9			
Conemaugh River,below S. Fk,Cr.Bel.S.Fk,Pa.	AKiCo 122	July 22	75	22.0	7.8	88.6	0.8* 1.9	**	2.9			
"	" "	" 30	60	21.5	6.8	76.3	0.4* 0.3	1	2.8			
"	" "	Aug. 7	52	21.0	7.3	80.9	0.7* 1.0	**	3.0			
South Fork Cr. above town, Beaversdale, Pa.	AKiCoSf 129	July 22	8	18.5	8.6	91.6	0.7	2	6.9		14	
"	" "	" 30	6	24.0	8.4	98.1	0.4	2	6.8		15	
"	" "	Aug. 7	6	18.0	8.6	90.1	0.6	2	7.0		17	
South Fork Creek above town, South Fork, Pa.	AKiCoSf 124	July 22	33	18.5	7.7	81.1	1.7* 6.6	**	2.8	67		
"	" "	" 30	24	24.5	7.5	88.4	0.4* 2.6	**	2.7	88		
"	" "	Aug. 7	19	18.5	7.8	82.5	1.9* 4.1	**	2.7	80		
Shade Creek below town, Central City, Pa.	AKiCoStS 134	July 18	6	15.5	8.8	87.9	1.6* 0.4	1	4.9			
"	" "	" 29	14	23.5	7.4	86.0	0.6* 0.5	24	3.8			
"	" "	Aug. 9	3	17.0	8.2	83.7	0.4* 0.2	4	4.0			
Shade Creek below town Reitz, Pa.	AKiCoStS 132	July 18	21	16.0	8.8	88.7	0.2* 0.5	**	2.7			
"	" "	" 29	64	22.5	7.9	90.4	0.4* 0.7	**	3.0			
"	" "	Aug. 9	9	16.5	8.4	85.7	0.8* 1.1	**	2.8			
Shade Creek at mouth Seanor, Pa.	AKiCoStS 123	July 18	38	20.0	8.9	97.1	0.1* 0.4	1	2.8	5		
"	" "	" 29	140	22.5	7.5	85.4	0.7* 0.9	21	3.4	42		
"	" "	Aug. 9	28	19.5	8.4	90.7	0.5* 0.6	**	2.8	3		
Stoney Cr. Bridge or Rt. Stoyestown, Pa. 30	AKiCoSt 135.5	July 17	65	17.0	9.0	92.6	0.7	43	6.9		17	
"	" "	" 26	101	22.5	7.7	88.5	1.0	1,100	6.7		19	
"	" "	Aug. 12	13	19.0	8.3	89.2	0.4* 0.4	**	3.6			

TABLE A-7 ALLEGHENY RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Stoney Cr. upper edge Hooversville, Pa.	AKiCoSt131.5	July 17		18.0	9.0	93.8	0.6* 0.6	110	5.2			
"	" "	" 26	147	22.5	7.7	88.2	1.1	93	6.1		15	
"	" "	Aug. 12	13	19.5	8.1	87.3	0.2* 0.6	**	3.5			
Stoney Cr. Bridge ½ mi. below Hooversville, Pa.	AKiCoSt129.5	July 17	80	18.5	8.9	94.5	0.6* 0.7	3	5.0			
"	" "	" 26	152	23.5	7.5	87.6	0.7* 0.7	24	4.2			
"	" "	Aug. 12	13	21.0	8.2	91.5	0.2* 0.3	1	3.3			
Quemahoning Cr. Upper edge Boswell, Pa.	AKiCoStQ133	July 17	50	17.5	8.3	86.3	0.6* 0.5	24	4.1			
"	" "	" 26	20	22.0	7.2	82.0	0.2* 0.4	9	3.0			
"	" "	Aug. 12	18	20.0	7.4	80.7	0.3* 0.5	**	2.9			
Quemahoning Cr. ½ mi. below sewers, Boswell, Pa	AKiCoStQ132	July 17	49	17.5	8.3	85.8	0.7* 0.9	15	4.8			
"	" "	" 26	22	22.5	7.1	81.4	0.4* 0.7	9	3.0			
"	" "	Aug. 12	17	20.5	5.7	62.8	0.6* 0.7	**	2.9			
Quemahoning Cr. at mouth Holsopple, Pa.	AKiCoStQ 125	July 17	9	18.0	6.3	66.2	1.2	93	6.6	55	28	92
"	" "	" 26	1	24.5	7.0	82.8	0.8	93	6.8	13	25	106
"	" "	Aug. 12	1	21.5	6.5	72.6	0.7	9	6.9	17	43	93
Stoney Cr. Upper edge of Holsopple, Pa.	AKiCoSt 124	July 17	91	19.0	8.9	94.9	0.5* 0.6	2	4.4			
"	" "	" 26	154	24.5	7.5	89.1	0.7* 0.9	46	4.1			
"	" "	Aug. 12	13	21.5	8.1	90.8	0.3* 0.4	**	3.3			
Stoney Creek ½ mi. below Holsopple, Pa.	AKiCoSt 123	July 17	93	19.5	8.7	94.1	0.4* 0.4	4	4.7	2		
"	" "	" 26	160	25.5	7.4	89.3	0.4* 0.6	23	4.2	27		
"	" "	12	13	22.5	7.9	90.4	0.2* 0.6	4	3.4			
Paint Creek, above town Windber, Pa.	AKiCoStP 125	July 18	5	19.5	8.2	88.1	0.4* 0.3	**	3.9			
"	" "	" 29	4	21.5	7.6	85.5	0.3* 0.4	2	3.4			
"	" "	Aug. 9	1	18.0	8.4	87.5	0.3* 0.4	**	3.6			
Paint Creek at mouth Scalp Level, Pa.	AKiCoStP119	July 18	11	19.5	8.5	91.4	0.8* 2.3	1	2.9	30		
"	" "	" 29	17	20.5	8.0	87.8	0.8* 1.2	1	2.8	40		
"	" "	Aug. 9	7	18.5	8.5	90.5	1.4* 2.8	**	2.9	31		
Stoney Creek above mou Paint Cr, Scalp Level, Pa.	AKiCoSt 119	July 18	97	20.5	8.6	94.7	0.3* 0.6	**	3.3			
"	" "	" 29	254	22.5	7.4	84.9	0.9* 1.1	240	3.4			
"	" "	Aug. 9	40	23.0	7.9	91.4	0.3* 0.6	**	2.9			
Stoney Cr. above Ferndale and Johnstown, Pa.	AKiCoSt113.5	July 29	604	22.0	7.2	81.2	0.8* 1.6	110	3.4			
"	" "	Aug. 9	88	19.5	8.4	90.5	0.6* 1.0	**	2.9			
"	" "	" 12	52	21.0	7.8	87.2	0.3* 0.4	**	2.8	2		
Stoney Cr. at mouth, Johnstown, Pa.	AKiCoSt109.5	July 18	170	22.5	8.9	102.2	1.2* 1.7	8	3.1	14		
"	" "	" 29	689	23.5	4.9	57.4	2.3* 3.4	24	2.8	290		
"	" "	Aug. 9	96	21.0	5.5	61.1	0.7* 0.8	**	2.9	8		

TABLE A-7 ALLEGHENY RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliform M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
					p.p.m.	% Sat.						
Conemaugh R. upper edge of Johnstown, Pa.	AKiCo 113	July 22	60	25.0	7.0	83.8	0.5* 0.5	**	2.9			
"	" "	" 30	75	23.5	6.6	77.2	0.2* 0.4	**	2.8			
"	" "	Aug. 7	50	22.0	7.3	83.0	0.9* 0.7	**	2.8			
Conemaugh R. above mouth of Stoney Creek	AKiCo 110	July 22	237	34.5	3.6	51.1	1.1* 2.6	4	4.3			
"	" "	" 30	208	33.5	3.8	53.5	2.4* 2.6	4	4.0			
"	" "	Aug. 7	183	32.0	3.1	42.0	1.7* 1.6	**	4.1			
Conemaugh R. RR bridge below Johnstown, Pa.	AKiCo 108	July 22	415	31.0	4.5	59.7	2.1* 3.7	4	4.5	108		
"	" "	"	646	29.0	5.5	70.5	1.8* 2.2	110	4.0	105		
"	" "	Aug. 7	320	28.0	4.0	50.5	2.3* 4.9	4	3.9	175		
Conemaugh R. Bridge above Seward, Pa.	AKiCo 101	July 23	360	27.5	4.0	50.1	1.3* 3.2	**	3.8			
"	" "	Aug. 1	275	25.5	6.8	81.3	0.6* 0.8	1	3.7			
"	" "	" 5	282	26.0	6.0	72.7	0.1* 0.7	**	3.6			
Conemaugh R. Br. on Rt. 259, Bolivar, Pa.	AKiCo 87	July 23	570	27.5	7.0	87.7	0.7* 0.6	9	3.7	3		
"	" "	Aug. 1	436	26.5	7.1	87.5	0.9* 1.1	**	3.5	10		
"	" "	" 5	370	26.0	7.5	90.8	0.5* 0.8	**	3.3	5		
Conemaugh R. upper edge of Blairsville, Pa.	AKiCo 79	Aug. 26	383	18.5	8.1	86.0	0.5* 0.8	9	3.1			
"	" "	Oct. 14	243	15.0	8.3	81.6	0.6* 0.6	**	3.5			
"	" "	Nov. 19	550	4.5	11.2	86.0	2.0* 2.8	**	4.6			
Conemaugh R. 500 yds. below Br. Blairsville	AKiCo 76	Aug. 26	388	18.5	7.8	82.3	0.5* 0.7	9	3.1			
"	" "	Oct. 14	245	15.5	8.4	83.6	0.5* 1.0	1	3.5			
"	" "	Nov. 19	550	4.5	11.2	86.4	1.5* 2.6	**	4.6			
McGee Run, upper edge of Derry, Pa.	AKiCoM 87	Sept. 9	**	13.0	9.6	90.1	0.3	**	6.9		28	
"	" "	Oct. 15	**	13.0	9.3	87.5	2.3	9	7.2		33	
McGee Run, 1/4 mi. below Derry, Pa.	AKiCoM 8	Sept. 9	1	17.5	4.7	49.2	14.0	24,000	7.2	18	72	115
"	" "	Oct. 15	2	15.0	4.2	41.4	33.1	24,000	7.2	15	87	100
S. Branch Blacklick Cr. 2 mi. above Nanty Glo, Pa	AKiCoBlSb 11	July 23	25	22.5	5.9	67.1	1.2* 0.8	**	2.7			
"	" "	Aug. 1	2	13.0	14.2	134.4	0.9* 1.9	**	3.0			
"	" "	" 5	2	14.0	7.6	72.9	0.6* 0.0	**	3.0			
S. Branch Blacklick Cr. 1½ mi. below Nanty Glo	AKiCoBlSb110	July 23	26	20.5	6.0	65.7	1.4* 1.6	**	2.6			
"	" "	Aug. 1	21	17.0	6.3	64.8	0.5* 4.3	**	2.6			
"	" "	" 5	22	18.5	6.4	67.7	0.2* 1.1	**	2.6			
S. Br. Blacklick Cr. above Vintondale, Pa.	AKiCoBlSb106	July 23	27	22.5	7.8	89.7	1.4* 0.7	**	2.4	4		
"	" "	Aug. 1	20	18.0	8.6	90.0	0.8* 0.3	**	2.6	9		
"	" "	" 5	13	19.5	8.1	87.9	0.2* 0.6	**	2.6	6		
N. Br. Blacklick Cr. Above town Vintondale	AKiCoBl 104	July 23	18	21.5	7.3	82.3	1.7* 1.8	**	2.6	22		
"	" "	Aug. 1	11	18.5	8.3	87.5	0.9* 1.1	**	2.8	13		

TABLE A-7 ALLEGHENY RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliform M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
					p.p.m.	% Sat.						
N.Br.Blacklick Cr. above town, Vintondale, Pa.	AKiCoBl 104	Aug. 5	10	18.5	8.0	85.3	0.1* 0.8	**	2.7	17		
Blacklick Creek, below Vintondale, Pa.	AKiCoBl 104	July 23	45	22.0	7.0	79.5	1.8* 1.2	**	2.5	18		
"	" "	Aug. 1	31	19.5	8.1	87.0	0.9* 0.7	**	2.5	15		
"	" "	" 5	31	19.0	7.4	79.1	0.4* 0.3	**	2.6	27		
Dixon Run ½ mi. below Dixonville, Pa.	AKiCoBlTD 105.5	Sept. 10	3	16.5	7.6	77.2	3.4	2,400	7.1	32	37	139
"	" "	Oct. 24	**	10.5	8.2	73.2	1.5	430	7.3		69	
"	" "	Nov. 14	4	5.5	11.0	87.3	1.8	230	7.0		34	
Dixon Run at mouth Clymer, Pa.	AKiCoBlTD102	Sept. 10	5	18.0	8.1	84.9	5.4* 5.4	46	3.7			
"	" "	Oct. 24	1	10.0	8.4	74.4	0.4* 2.8	1	3.3	10		408
"	" "	Nov. 14	5	5.5	11.2	89.0	0.8* 1.9	2	4.3	18		258
Marsh Run, at upper edge of Indiana, Pa.	AKiCoBlW 95	Sept. 11	**	10.5	7.9	70.2	2.4	240	7.1		69	
"	" "	Oct. 25	**	8.5	6.7	57.2	6.4	150	7.3		85	
"	" "	Nov. 14	**	6.0	9.2	74.0	1.8	7	7.0		46	
"	" "	Sept. 11	**	12.0	8.7	80.3	1.1	21	7.0	10	54	73
"	" "	Oct. 25	**	8.5	7.8	66.5	4.8	4	7.0	7	52	63
"	" "	Nov. 14	**	5.0	10.0	77.7	1.2	1	6.9	5	50	77
Marsh Run below mouth of White Run	AKiCoBl 92	Sept. 11	**	12.5	7.0	65.0	1.8	460	7.1	13	79	158
"	" "	Oct. 25	**	8.5	6.8	57.5	1.8	36	7.3	7	93	287
"	" "	Nov. 14	**	6.5	8.6	70.0	2.3	75	7.2	8	75	144
Two Lick Creek 1/4 mi. above Homer City, Pa.	AKiCoBlT 88	Sept. 11	19	15.0	9.2	90.4	1.0* 1.0	**	3.1			
"	" "	Oct. 25	7	8.5	9.9	84.7	1.5* 1.5	**	3.7			
"	" "	Nov. 14	31	5.5	11.7	92.7	1.1* 1.3	**	3.7			
Two Lick Cr. 1/4 mile below Homer City, Pa.	AKiCoBlT 87	Sept. 11	33	19.0	8.1	86.2	1.1* 1.3	2	3.0			
"	" "	Oct. 25	14	13.0	8.7	82.5	0.9* 1.0	2	3.3			
"	" "	Nov. 14	45	12.5	8.0	75.2	1.1* 1.2	240	3.8			
Yellow Cr. water plant below dam, Homer City, Pa.	AKiCoBlY 88	Sept. 11	13	27.5	6.8	85.4	0.8* 2.3	**	3.3	22		240
"	" "	Oct. 25	6	29.5	6.1	79.7	0.9* 1.2	2	3.4	9		278
"	" "	Nov. 14	14	18.5	8.5	90.0	0.9* 1.1	1	3.7	16		252
Two Lick Cr. at mouth, Josephine, Pa.	AKiCoBlT 83	Sept. 11	38	17.0	8.6	88.0	0.7* 1.4	**	3.1			330
"	" "	Oct. 25	19	10.5	9.3	83.3	1.3* 1.1	**	2.9	4		483
"	" "	Nov. 14	47	7.5	10.8	89.4	0.9* 2.7	**	3.4	4		307
Blacklick Cr. upper edge Blacklick, Pa.	AKiCoBl 81	Aug. 26	121	16.5	8.8	89.6	0.8* 0.9	**	2.6			
"	" "	Oct. 14	40	12.5	9.1	84.9	4.0* 4.9	**	2.6			
"	" "	Nov. 19	155	0.5	12.4	85.7	0.4* 1.0	**	3.3			
Blacklick Cr. ½ mi. below Blacklick, Pa.	AKiCoBl 81	Aug. 26	124	16.5	8.9	90.4	1.1* 0.8	**	2.7	7		426
"	" "	Oct. 14	40	12.5	9.5	89.0	0.4* 4.8	**	2.4	9		462
"	" "	Nov. 19	160	1.0	13.0	91.2	0.7* 1.6	**	3.2	120		246

TABLE A-7 ALLEGHENY RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Conemaugh R. water plant intake, abv. Saltsburg, Pa.	AKiCo 58	Aug. 26	507	18.5	8.4	89.1	0.5* 0.7	**	2.9	5		356
"	" "	Oct. 14	275	14.5	9.0	87.2	0.8* 0.8	**	2.8	6		374
"	" "	Nov. 19	740	3.0	12.0	88.9	0.8* 1.8	**	3.9	65		166
Mill Creek at mouth, Ligonier, Pa.	AKiLoM 91	Sept. 9	12	18.5	7.9	83.5	0.6* 0.9	9	2.9	8		295
"	" "	Oct. 15	3	14.0	8.1	77.8	1.5* 1.9	**	2.9	5		374
Loyalhanna Cr. above all camps, Ligonier, Pa	AKiLo 91.5	Sept. 9	26	18.0	8.9	93.1	0.8	460	7.3		27	
Loyalhanna Cr. above, Ligonier, Pa.	AKiLo 91.5	Oct. 15	3	13.5	6.3	79.3	1.8	4	7.3		41	
Loyalhanna Cr. 3/4 mi. below Ligonier, Pa.	AKiLo 89.5	Sept. 9	41	19.0	6.9	73.8	1.2* 1.2	9	4.7			
"	" "	Oct. 15	8	14.5	4.5	43.9	1.2* 1.7	2	3.3	10		232
Loyalhanna Cr. 1 mi. above Latrobe, Pa.	AKiLo 82.5	Sept. 9	230	18.5	8.5	89.7	0.9	2	6.1		9	
"	" "	Oct. 15	14	15.0	9.0	89.2	0.4* 0.7	**	4.5			
Saxman Run, upper edge Bradenville, Pa.	AKiLoS 85	Sept. 9	1	16.5	8.7	88.6	0.6* 0.7	8	4.3			
"	" "	Oct. 15	1	14.5	8.5	83.1	1.1* 2.1	3	3.5			
Saxman Run, 1/2 mile below Bradenville, Pa.	AKiLoS 84	Sept. 9	1	16.5	8.7	88.4	0.3* 0.8	9	4.2	18		246
"	" "	Oct. 15	1	14.5	8.5	82.7	0.8* 1.5	2	3.6	8		305
Loyalhanna Cr. below Saxman Run, below Latrobe	AKiLo 78	Sept. 9	234	18.5	5.3	56.4	1.5* 3.5	110	3.5	100		
"	" "	Oct. 15	15	15.0	1.8	17.7	1.3* 3.1	**	3.1	12		
Crabtree Cr. upper edge of Crabtree, Pa.	AKiLoC 73	Sept. 18	**	12.5	9.5	88.5	0.3* 0.5	**	4.0			
"	" "	Oct. 29	**	8.0	10.1	85.0	1.2* 1.4	2	4.2			
Crabtree Cr. 1/2 mi. below Crabtree, Pa.	AKiLoC 72	Sept. 18	12	14.5	9.4	91.3	0.5* 5.6	**	2.6	135		1,264
"	" "	Oct. 29	13	11.5	5.4	49.3	3.4* 25.1	**	3.1	15		1,174
Loyalhanna Cr. at mouth Saltsburg, Pa.	AKiLo 58	Aug. 26	51	17.0	8.8	89.9	1.0* 0.9	**	2.6	8		649
"	" "	Oct. 14	36	12.5	9.8	91.4	0.7* 0.9	**	2.6	7		558
"	" "	Nov. 19	120	0.5	13.1	90.7	0.5* 3.6	**	3.3	125		275
Kiskiminetas R. 100 yds below sewer, Saltsburg	AKi 56.5	Aug. 26	560	18.5	8.4	89.4	0.4* 0.5	**	2.9	4		355
"	" "	Oct. 14	311	14.5	8.9	86.9	0.0* 4.6	**	2.8	5		401
"	" "	Nov. 19	860	1.0	13.0	91.0	0.8* 2.1	**	3.3	40		203
Harper Run, below Iselin, Pa.	AKiBlH 61	Aug. 26	1	14.5	9.2	89.5	1.4* 1.4	24	4.3	150		192
"	" "	Oct. 14	**	9.5	10.3	90.0	3.2* 1.0	**	2.9	5		634
"	" "	Nov. 19	1	3.0	12.0	89.4	0.4* 0.5	**	3.4	75		422
Kiskiminetas R. Hgwy. Br. above Avonmore, Pa.	AKi 52.5	Aug. 29	1,160	21.0	8.0	89.3	0.4* 0.4	**	3.2			
"	" "	Sept. 30	402	13.5	9.0	86.0	0.5* 1.4	**	3.0			
"	" "	Nov. 29	1,620	0.5	14.3	98.9	1.1* 1.1	4	3.9			

TABLE A-7 ALLEGHENY RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Kiskiminetas River, above Salina, Pa.	AKi 50	Aug. 29	1,180	21.0	7.7	85.2	0.5* 1.2	**	3.0			
"	" "	Sept.30	403	14.0	9.0	86.5	0.5* 0.9	**	2.8			
"	" "	Nov. 29	1,680	1.5	12.6	89.9	0.7* 2.5	4	3.5			
Kiskiminetas R. 1/2 mi. below Salina, Pa.	AKi 49	Aug. 29	1,170	21.5	7.7	86.5	0.4* 1.2	**	3.0			
"	" "	Sept.30	403	14.5	9.0	87.9	0.4* 1.2	**	2.9			
"	" "	Nov. 29	2,700	1.5	13.1	93.4	1.1* 2.6	4	3.7			
Kiskiminetas R. above Apollo, Pa.	AKi 45	Aug. 29	1,180	21.5	7.9	88.2	0.8* 1.4	**	2.9			
"	" "	Sept.30	423	14.5	9.0	87.8	0.7* 1.1	**	2.9			
"	" "	Nov. 29	1,910	1.5	13.7	97.3	0.6* 2.6	4	3.7			
Kiskiminetas R. above Vandergrift, Pa.	AKi 40.5	Aug. 29	1,280	22.0	7.2	81.1	0.8* 1.2	**	2.9			
"	" "	Sept.30	425	14.5	9.1	88.9	0.6* 0.7	**	2.8			
"	" "	Nov. 29	2,090	1.5	14.0	99.5	1.4* 2.5	21	3.7			
Kiskiminetas River, near Brady Run, Leechbg.	AKi 36.5	Aug. 29	1,310	22.0	7.0	78.7	0.4* 2.0	**	3.0	13		349
"	" "	Sept.30	438	15.5	8.6	85.3	0.6* 2.1	**	2.9	10		360
"	" "	Nov. 29	2,210	1.0	13.7	96.4	0.4* 1.3	4	4.1	38		170
Kiskiminetas R. near Hyde Park, W. Leechburg, Pa.	AKi 34.5	Aug. 29	1,300	22.5	7.9	90.5	0.5* 2.1	**	3.1			
"	" "	Sept.30	435	15.0	8.7	86.0	0.6* 0.8	1	3.0			
"	" "	Nov. 29	2,170	1.5	13.7	97.9	0.6* 4.1	8	3.9			
Kiskiminetas R. at mouth, Freeport, Pa.	AKi 31	Aug. 20	465	25.0	7.5	89.0	1.6	3	7.4	10	45	98
"	" "	" 28	1,470	19.5	7.3	76.5	0.8* 1.2	**	2.9	10		324
"	" "	Sept.12	1,180	17.0	8.0	82.2	1.1* 1.3	**	2.9	5		270
"	" "	" 20	450	20.0	7.4	80.2	0.5* 1.7	**	2.9	7		301
"	" "	Sept.23	440	21.5	7.3	81.7	0.7* 0.9	**	2.8	6		329
"	" "	Oct. 3	403	16.0	8.4	84.2	0.9* 2.8	**	3.0	5		356
"	" "	" 7	367	18.5	8.4	89.3	0.9* 1.0	**	2.9	7		315
"	" "	Oct. 15	335	14.0	8.4	80.8	1.1* 4.1	**	2.8	6		386
"	" "	" 21	362	7.5	11.0	91.2	1.8* 1.8	**	2.8	5		428
"	" "	" 31	630	10.5	9.7	86.2	1.4* 3.1	**	3.0	5		403
"	" "	Nov. 5	1,400	10.5	9.9	88.3	0.9* 3.6	1	3.5	8		225
"	" "	" 22	1,120	7.5	10.9	91.0	1.2* 3.0	**	3.3	9		297
"	" "	" 25	1,150	6.0	9.8	78.8	0.9* 1.9	1	3.3	5		282
"	" "	Dec. 6	2,000	0.0	13.6	93.0	0.7* 2.1	1	3.6	5		175
"	" "	" 11	3,480	4.0	12.4	94.7	0.5* 2.3	1	3.6	6		198
Allegheny River, Lock and Dam No. 4, Breckinridge, Pa.	A 24.2	Aug. 20	2,340	25.5	7.1	85.1	0.3* 0.4	**	4.3			
"	" "	" 28	4,170	21.0	8.3	92.3	0.2* 0.3	**	4.3			
"	" "	Sept.12	5,760	19.5	8.5	91.6	0.8	**	6.1		10	
"	" "	" 20	2,970	19.5	8.2	88.8	0.6	3	6.4		13	
"	" "	" 23	2,550	20.5	7.8	85.[illegible]	1.1	24	6.4		14	
"	" "	Oct. 3	3,470	16.5	9.2	92.9	0.6	23	6.9		29	

TABLE A-7 ALLEGHENY RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth		Date 1946	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
						p.p.m.	% Sat.						
Lock & Dam #4, Allegheny River	A	24.2	Oct. 7	3,050	17.0	9.2	94.4	0.7	2	6.6		20	
"	"	"	" 16	2,560	14.7	8.8	86.4	1.4* 1.2	**	5.5			
"	"	"	" 21	2,560	11.5	9.1	83.2	0.7* 0.7	**	5.7			
"	"	"	" 31	3,100	11.0	10.0	90.3	0.8	**	6.5		19	
"	"	"	Nov. 5	9,000	11.0	10.5	95.0	1.2	15	7.0		45	
"	"	"	" 22	12,300	5.0	12.3	96.0	0.9	9	6.9		31	
"	"	"	" 25	14,500	6.0	12.1	96.6	1.2	43	7.2		29	
"	"	"	Dec. 6	14,500	0.5	14.2	98.3	1.6	46	7.0		28	
"	"	"	" 11	34,500	1.0	14.4	101.5	2.4	46	6.9		22	
Allegheny River, Lock & Dam #3, Springdale, Pa.	A	17	Aug. 20	2,360	28.0	6.8	76.8	0.5* 0.8	**	4.4			
"	"	"	" 28	4,210	24.5	7.9	94.0	0.5* 0.5	**	4.3			
"	"	"	Sept.5	6 000	24.0	8.6	100.2	0.8	240	6.7		24	
"	"	"	" 12	5,310	21.0	8.8	98.3	1.1	102	6.7	10	25	111
"	"	"	" 20	3,200	22.0	8.4	95.1	0.8	24	6.7	10	21	116
"	"	"	" 23	3,110	23.0	8.0	92.5	1.3	93	6.7	12	16	120
"	"	"	Oct. 3	4,000	19.0	9.0	96.6	1.2	460	6.9	8	34	110
"	"	"	Oct. 17	3 110	19.0	8.8	94.4	1.0	43	6.8	10	26	119
"	"	"	" 16	2,750	18.0	9.0	94.1	1.1	9	6.8	7	15	111
"	"	"	" 21	2,750	14.5	9.0	88.0	1.2* 1.2	1	5.7	4		123
"	"	"	" 31	3,110	14.0	10.0	96.6	1.5	2	6.5	6	14	131
"	"	"	Nov. 5	9,200	10.5	11.2	99.9	1.7	43	6.7	5	26	120
"	"	"	" 22	12,500	6.5	12.4	100.4	1.2	46	6.8	10	26	91
"	"	"	" 25	15,500	6.0	12.8	102.6	1.8	110	7.2	12	31	82
"	"	"	Dec. 6	15,100	1.0	14.2	99.8	1.2	24	7.0	8	22	63
"	"	"	" 11	37,500	1.5	14.6	103.8	1.5	46	6.9	12	21	64
Allegheny R. Lock & Dam #2, Pittsburgh, Pa.	A	6.7	Aug. 20	2,380	27.0	6.8	84.5	1.5	2,400	6.6	6	9	130
"	"	"	" 28	4,240	24.0	8.1	94.6	0.5* 0.5	36	4.4	3		
"	"	"	Sept.5	6,050	23.0	8.6	98.7	1.3	460	6.5	7	12	130
"	"	"	" 16	2,700	20.0	8.6	93.3	1.0	460	6.7		14	
"	"	"	" 25	3,790	21.0	8.2	91.1	2.1	448	6.8		17	
"	"	"	Oct. 4	3,240	16.0	9.1	91.7	1.2	43	6.8		33	
"	"	"	" 9	2,760	18.0	8.9	93.6	1.5	240	6.9		26	
"	"	"	" 18	2,800	15.5	9.3	92.3	2.9	460	6.9		19	
"	"	"	" 23	2,800	13.0	9.4	88.8	1.5	240	6.7		13	
"	"	"	Nov. 1	9,300	13.5	9.7	92.8	2.5	460	6.8		14	
"	"	"	" 6	8,660	10.5	12.0	107.0	1.8	37	7.0		24	
"	"	"	" 13	9,300	7.5	12.5	104.2	1.9	240	7.0		33	
"	"	"	" 27	15,200	6.5	12.4	100.6	1.3	150	6.8		28	
"	"	"	Dec. 4	22,700	0.5	15.9	110.0	2.5	838	6.8		22	
"	"	"	" 10	39,800	1.0	15.0	105.1	1.9	93	6.6		25	
Allegheny R. at mouth, Pittsburgh, Pa.	A	1.7	Sept. 16	2,700	20.0	5.9	63.9	3.0	363	6.8	10	23	118
"	"	"	" 25	3,790	21.5	2.0	22.7	5.8	2,400	6.8	8	21	123
"	"	"	Oct. 4	3,240	16.0	3.1	32.1	5.4	930	6.7	12	40	102
"	"	"	" 9	2,760	19.0	3.8	40.1	1.8* 1.8	240	4.7	10		112
"	"	"	" 18	2,800	16.0	2.6	26.0	7.0	930	6.8	10	23	132

TABLE A-7 ALLEGHENY RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml.	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Allegheny River, at mouth, Pittsburgh, Pa.	A 1.7	Oct. 23	2,800	13.5	4.4	42.4	4.1	230	6.5	7	17	116
"	" "	Nov. 1	9,300	13.5	5.5	52.9	4.1	763	6.9	6	14	124
"	" "	" 6	8,660	10.5	10.9	97.4	2.1	230	6.9	6	18	130
"	" "	" 13	9,300	8.5	11.6	98.5	2.1	230	7.0	16	35	100
"	" "	" 27	15,200	6.0	13.5	108.3	2.3	430	7.0	12	27	90
"	" "	Dec. 4	22,700	1.0	15.8	110.8	1.6	36	6.7	12	19	71
"	" "	" 10	19,800	1.5	14.8	105.6	1.8	43	6.7	90	22	76

* Seeded and neutralized.

** Less than one

Table A-7A Allegheny River Basin - Laboratory Data - Acid Stream Results

Stream	Sampling Point	Month 1940	No. Samples	pH	ACIDITY P.P.M.			IRON P.P.M.	
					Methyl Red	Phenolphthalein Hot	Phenolphthalein Cold	Ferrous	Total
Elk Creek	Abv. St. Marys, Pa.	Sept.	1	3.1	118	236	188	6	60
Mile 181	Mile 193.5	Oct.	1	3.1	198	322	278	9	80
		Nov.	1	3.1	428	486	472	15	100
Toby Creek	Abv. Brockway, Pa.	Sept.	1	3.2	98	118	102	1.4	40
Mile 172	Mile 184.5	Oct.	1	3.0	108	124	102	0.7	60
		Nov.	1	3.1	92	128	88	1.8	40
	Bel. Brockway, Pa.	Sept.	1	3.4	66	182	178	1.0	18
	Mile 182.5	Oct.	1	3.0	136	160	140	0.3	25
		Nov.	1	3.1	134	166	166	1.8	22
	Mouth - Mile 172	Sept.	1	3.2	144	234	138		4
		Oct.	1	3.0	244	284	256	0.3	6
		Nov.	1	3.2	170	284	202	0.5	12
Clarion River Mile 86.1	Portland Mills, Pa. Mile 173	Oct.	1	4.7	32	56	48	0.2	4
Soldiers Run Mile 129	Abv. Reynoldsville, Pa. Mile 132	Oct.	2	3.0	295	379	358	3.0	108
Sugar Camp Run Mile 127	Sykesville, Pa. Mile 127.5	Oct.	1	6.3	144	228	208	50	175
Stump Creek Mile 121	3 Mi. bel. Sykesville, Pa. - Mile 124	Oct.	1	5.8	146	262	262	9	75
Mahoning Creek Mile 56.2	Abv. Punxsutawney, Pa. Mile 113	Oct.	1	4.7		55	40	0.2	2
	Bel. Punxsutawney, Pa. Mile 109	Oct.	1	5.2		34	34	0.4	4
Craig Run	Mouth, Rural Valley, Pa.	Sept.	1	3.1	197	355	317	6.0	57
Mile 62.5	Mile 62.5	Oct.	1	2.8	253	382	312	13.5	44
		Nov.	1	3.3			292	44	88
Cowanshannock Cr.	Abv. Rural Valley, Pa.	Sept.	1	2.9	300	377	367	8	57
Mile 48.5	Mile 63	Oct.	1	2.8	354	489	434	20	125
		Nov.	1	3.3			482	13	42
	Bel. Yatesboro, Pa.	Sept.	1	3.2	162	249	216	9	34
	Mile 60	Oct.	1	2.9	248	398	334	38	75
		Nov.	1	3.5			116	15	46
N.Br.Plum Cr.	Abv. Sagamore, Pa.	Sept.	1	3.2	64	84	75		2
Mile 73	Mile 78	Oct.	1	2.9	104	158	136	1.3	8
		Nov.	1	4.0			24		4
	Bel. Sagamore, Pa.	Sept.	1	3.2	102	138	129	6.5	18
	Mile 77	Oct.	1	3.6	87	205	172	35	42
		Nov.	1	3.9			67	16.5	24
Conemaugh R.	Abv. Lilly, Pa.	July	2	3.4	45**	108**	67	5.8**	
Mile 57.0	Mile 136.5	Aug.	1	4.1	26	67	45		2.4
	Bel. Lilly, Pa.	July	2	3.0	112	178	145	8.2**	11
	Mile 135.5	Aug.	1	3.0			106		12
	Abv. Portage, Pa.	July	2	3.0	199	314	249	6.2**	33
	Mile 131	Aug.	1	3.0			328	2.2	44
Trout Run	Mouth, Portage, Pa.	July	2	2.6	541	855	687	7.5	135
Mile 130	Mile 129	Aug.	1	2.7				7	240
Conemaugh R.	Abv. Portage, Pa.	July	2	2.6	202	318	208	4.4	32
Mile 57.0	Mile 131	Aug.	1	2.7			236	2.3	30
	Abv. South Fork, Pa.	July	2	2.9	272	411	355	77.5**	120**
	Mile 123	Aug.	1	2.9			152		11.5
	Bel. South Fork, Pa.	July	2	2.8	230	347	285	22.4**	42
	Mile 122	Aug.	1	3.0			299	1.8	37
South Fork Cr.	Abv. South Fork, Pa.	July	2	2.8	406	650	545	65	153
Mile 122	Mile 124	Aug.	1	2.7			675	17	164
Shade Creek	Bel. Central City, Pa.	July	2	4.4	9	22	20		3.0
Mile 122	Mile 134	Aug.	1	4.0			16		6.6
	Bel. Ritz, Pa.	July	2		138	248	171	4.4	35
	Mile 132	Aug.	1				290	4.6	48
	Mouth, Seanor, Pa.	July	2	3.1	50	85	72		11
	Mile 123	Aug.	1	2.8			151		14
Stony Creek Mile 109.5	Stoyestown, Pa. Mile 135.5	Aug.	1	3.6			27		3.3
	Abv. Hooversville, Pa.	July	1	5.2		12	6		1.8
	Mile 131.5	Aug.	1	3.5			35		2.6
	Bel. Hooversville, Pa.	July	2	4.6	6**	20	15		3.5
	Mile 129.5	Aug.	1	3.3			67		2.8

Table A-7A Allegheny River Basin (Continued)

Stream	Sampling Point	Month 1940	No. Samples	pH	ACIDITY P.P.M.			IRON P.P.M.	
					Methyl Red	Phenolphthalein Hot	Phenolphthalein Cold	Ferrous	Total
Quemahoning Cr. Mile 125	Abv. Boswell, Pa. Mile 133	July	2	3.6	59	93	76		6
		Aug.	1	2.9			170		22
	Bel. Boswell, Pa. Mile 132	July	2	3.9	47	88	70		7
		Aug.	1	2.9			212		26
Stony Creek Mile 109.5	Abv. Holsopple, Pa. Mile 124	July	2	4.2	8	19	14		3
		Aug.	1	3.3			63		2.6
	Bel. Holsopple, Pa. Mile 123	July	2	4.4	7	18	15		2.8
		Aug.	1	3.4			58		2.6
Paint Creek Mile 119	Abv. Windber, Pa. Mile 125	July	2	3.6	44	75	59		2.7
		Aug.	1	3.6			69		23
	Mouth, Scalp Level, Pa. Mile 119	July	2	2.8	222	340	286	15	38
		Aug.	1	2.9			365	7	64
Stony Creek Mile 109.5	Abv. Mouth Paint Cr., Scalp Level, Pa.-Mi.119	July	2	3.4	31	50	42	2.8**	11
		Aug.	1	2.9			121		17
	Abv. Ferndale, Johnstown, Pa.-Mile 113.5	July	1	3.4	25	43	36		26
		Aug.	2	2.8			191		15
	Mouth, Johnstown, Pa. Mile 109.5	July	2	3.0	78	114	94	1.8**	66
		Aug.	1	2.9			167		50
Conemaugh River Mile 57.0	Abv. Johnstown, Pa. Mile 113	July	2	2.8	243	375	302	12.6**	28
		Aug.	1	2.8			362		125
	Abv. Mouth Stony Creek Mile 110	July	2	4.2	51	128	93	13.2	43
		Aug.	1	4.1			98	5	68
	Bel. Johnstown, Pa. Mile 108	July	2	4.2	31	64	52	7.6	28
		Aug.	1	3.9			89	4.2	26
	Abv. Seward, Pa. Mile 101	July	1	3.8	82	163	127	8.6	10
		Aug.	2	3.6	39**	94**	79	3.6**	9
	Bolivar, Pa. Mile 87	July	1	3.7	57	120	96		2.5
		Aug.	2	3.4	39**	77*	72		4.4
	Abv. Blairsville, Pa. Mile 79	Aug.	1	3.1	64	116	83	1.3	8
		Oct.	1	3.5	52	112	79		2.8
		Nov.	1	4.6			48	7.8	12.0
	Bel. Blairsville, Pa. Mile 76	Aug.	1	3.1	65	114	85		12
		Oct.	1	3.5	63	110	72	0.5	8.8
		Nov.	1	4.6			42	10.5	16.0
South Branch Blacklick Creek Mile 105	Abv. Nanty Glo, Pa. Mile 113	July	1	2.7	550	765	652		122
		Aug.	2	3.0	1400**	3410**	3295	1275	1600
	Bel. Nanty Glo, Pa. Mile 110	July	1	2.6	683	968	856	21.7	220
		Aug.	2	2.6	746**	1012**	1001	38	235
	Abv. Vintondale, Pa. Mile 106	July	1	2.4	813	1132	1062	17.5	245
		Aug.	2	2.6	810**	1047**	1017	2.7	222
North Branch Blacklick Cr. - Mi.105	Abv. Vintondale, Pa. Mile 105	July	1	2.6	657	871	796	21	160
		Aug.	2	2.8	270**	377**	418	4.7**	67
Blacklick Creek Mile 73.5	Bel. Vintondale, Pa. Mile 104	July	1	2.5	702	916	806	9	152
		Aug.	2	2.6	432**	602**	604	8**	102
Dixon Run Mile 102	Mouth, Clymer, Pa. Mile 102	Sept.	1	3.7	33	68	48	6	25
		Oct.	1	3.3	126	248	175	23	24
		Nov.	1	4.3			52	14.5	23
Two Lick Creek Mile 83	Abv. Homer City, Pa. Mile 88	Sept.	1	3.1	112	148	131		1
		Oct.	1	3.7	98	197	127		5
		Nov.	1	3.7			58		6
	Bel. Homer City, Pa. Mile 87	Sept.	1	3.0	101	121	118		7
		Oct.	1	3.3	100	144	128		10
		Nov.	1	3.8			35		7
Yellow Creek Mile 88	Water Plant-Homer City, Pa. - Mile 88	Sept.	1	3.3	102	125	114		12
		Oct.	1	3.4	60	99	74		3
		Nov.	1	3.7			29		12
Two Lick Creek Mile 83	Mouth, Josephine, Pa. Mile 83	Sept.	1	3.1	141	195	162		21
		Oct.	1	2.9	191	298	236		35
		Nov.	1	3.4			101	1.8	19
Blacklick Cr. Mile 73.5	Abv. Blacklick, Pa. Mile 82	Aug.	1	2.6	395	559	458	0.8	110
		Oct.	1	2.6	585	780	703	2.8	93
		Nov.	1	3.3			199	7.4	23
	Bel. Blacklick, Pa. Mile 81	Aug.	1	2.7	422	572	511	1.6	115
		Oct.	1	2.4	612	788	739	2.0	98
		Nov.	1	3.2			208	8.0	23

Table A-7A Allegheny River Basin (Continued)

Stream	Sampling Point	Month 1940	No. Samples	pH	ACIDITY P.P.M.			IRON P.P.M.	
					Methyl Red	Phenolphthalein Hot	Phenolphthalein Cold	Ferrous	Total
Conemaugh River Mile 57.0	Water Plant-Saltsburg, Pa. - Mile 58	Aug.	1	2.9	146	219	174		22
		Oct.	1	2.8	176	242	205		26
		Nov.	1	3.9			69	6.4	20
Mill Creek Mile 90	Mouth, Ligonier, Pa. Mile 91	Sept.	1	2.9	87	124	101		13
		Oct.	1	2.9	210	294	255	2.6	35
Loyalhenna Creek Mile 57	Bel. Ligonier, Pa. Mile 89.5	Sept.	1	4.7	3	9	14		3
		Oct.	1	3.3	90	148	122	3.4	16
	Abv. Latrobe, Pa. Mile 82.5	Oct.	1	4.5	12	27	20		3
Saxman Run Mile 82	Abv. Bradenville, Pa. Mile 85	Sept.	1	4.3	25	41	39		7
		Oct.	1	3.5	62	100	81		8
	Bel. Bradenville, Pa. Mile 84	Sept.	1	4.2	19	42	32		7
		Oct.	1	3.6	53	99	75		2.6
Loyalhanna Creek Mile 57	Bel. Latrobe, Pa. Mile 78	Sept.	1	3.5	94	128	118	22	46
		Oct.	1	3.1	217	469	452	87.4	110
Crabtree Creek Mile 71	Abv. Crabtree, Pa. Mile 73	Sept.	1	4.0	223	328	276		4
		Oct.	1	4.2	143	242	196		2
	Bel. Crabtree, Pa. Mile 72	Sept.	1	2.6	2340	3110	3010	255	591
		Oct.	1	3.1	1920	2930	2460	180	494
Loyalhanna Creek Mile 57	Mouth, Saltsburg, Pa. Mile 58	Aug.	1	2.6	506	736	612		175
		Oct.	1	2.6	494	608	571		79
		Nov.	1	3.3			197	28	38
Kiskiminetas River Mile 30.2	Bel. Saltsburg, Pa. Mile 56.5	Aug.	1	2.9	143	225	184		16
		Oct.	1	2.8	170	242	215		33
		Nov.	1	3.3			113	15.2	18
Harper Run Mile 59	Bel. Iselin, Pa. Mile 61	Aug.	1	4.3	16	44	35		6
		Oct.	1	2.9	338	413	388		70
		Nov.	1	3.4			158		12
Kiskiminetas River Mile 30.2	Abv. Avonmore, Pa. Mile 52.5	Aug.	1	3.2	100	171	144	5.2	14
		Sept.	1	3.0	146	249	181	4.0	16
		Nov.	1	3.9			58	1.3	18
	Abv. Salina, Pa. Mile 50	Aug.	1	3.0	119	173	148	2.6	13
		Sept.	1	2.8	157	236	196	3.0	16
		Nov.	1	3.5			63		17
	Bel. Salina, Pa. Mile 49	Aug.	1	3.0	118	172	146	3.4	13
		Sept.	1	2.9	159	240	199	4.0	16
		Nov.	1	3.7			56	0.7	19
	Abv. Apollo, Pa. Mile 45	Aug.	1	2.9	119	167	151	2.6	18
		Sept.	1	2.9	163	226	189	2.5	16
		Nov.	1	3.7			67	2.6	18
	Abv. Vandergrift, Pa. Mile 40.5	Aug.	1	2.9	126	173	159	6.6	13
		Sept.	1	2.8	158	230	190	0.4	17
		Nov.	1	3.7			68	8.5	20
	Leechburg, Pa. near Brady Run - Mile 36.5	Aug.	1	3.0	127	203	178	10.4	22
		Sept.	1	2.9	129	193	157	1.2	11
		Nov.	1	4.1			84	8.5	18
	West Leechburg, Pa. Hyde Park - Mile 34.5	Aug.	1	3.1	122	197	176	12.4	22
		Sept.	1	3.0	128	199	160		12
		Nov.	1	3.9			82	13.0	21
	Mouth, Freeport, Pa. Mile 31	Aug.	1	2.9	177	252	221	2.3	22
		Sept.	3	2.9	166	221	194	2.7*	30
		Oct.	5	2.9	200	282	278	9.8	38
		Nov.	3	3.3	74	138	107	6.1	27
		Dec.	2	3.6	43**	80**	60	3.7	32
Allegheny River	Lock & Dam #4 Mile 24.2	Aug.	2	4.3	14	33	30		0.5
		Oct.	2	5.6	5	13	14	6**	7.5
	Lock & Dam #3 Mile 17	Aug.	2	4.4	10	29	20		0.5
		Oct.	1	5.7	3	10	12		0.7
	Lock & Dam #2 Mile 6.7	Aug.	1	4.4	9	24	18		0.2
	Mouth, Pittsburgh, Pa. Mile 1.7	Oct.	1	4.7	4	10	11		2.4

** One sample.
* Two samples.

MONONGAHELA RIVER BASIN

Final Report to the Ohio River Committee
Ohio River Pollution Survey

U. S. Public Health Service
Cincinnati, Ohio
1942

244 C

MONONGAHELA RIVER BASIN

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Fig. Mo-1

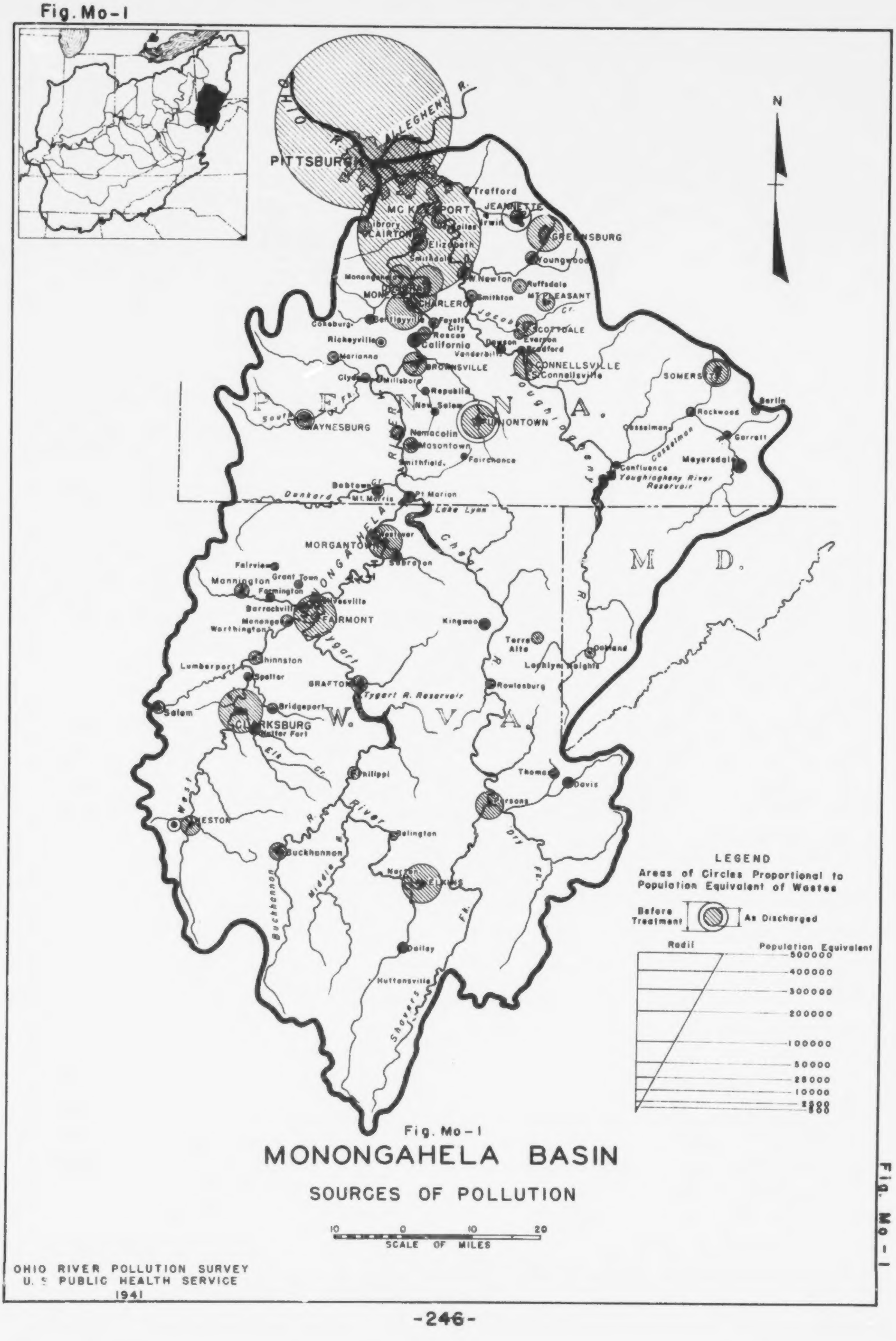
OHIO R.
ALLEGHENY R.
PITTSBURGH
Trafford
MC KEESPORT
JEANNETTE
Irwin
Library
CLAIRTON
Versailles
Elizabeth
GREENSBURG
Smithdale
Youngwood
Monongahela
W. Newton
Ruffsdale
DONORA
MONESSEN
CHARLEROI
Smithton
MT PLEASANT
Jacobs Cr.
Cokeburg
Bentleyville
Fayette City
Roscoe
California
SCOTTDALE
Everson
Dawson
Richeyville
Vanderbilt
Bradford
Marianna
BROWNSVILLE
CONNELLSVILLE
S. Connellsville
SOMERSET
Clyde
Millsboro
Republic
Berlin
P E N N A.
New Salem
South Fk.
WAYNESBURG
UNIONTOWN
Youghiogheny
Rockwood
Casselman
Garrett
Nemacolin
Masontown
Casselman
Meyersdale
Smithfield.
Fairchance
Confluence
Youghiogheny River Reservoir
Bobtown
Dunkard Cr.
Mt. Morris
Pt Marion
Lake Lynn
MORGANTOWN
Westover
Sabraton
Cheat
MONONGAHELA RIVER
M D.
Fairview
Monnington
Grant Town
Farmington
Rivesville
Barrackville
Monongah
FAIRMONT
Worthington
Kingwood
Tygart
Terra Alta
Oakland
Shinnston
Loch Lynn Heights
Lumberport
Spelter
GRAFTON
Tygart R. Reservoir
Rowlesburg
Salem
Bridgeport
CLARKSBURG
Nutter Fort
W. V A.
Elk Cr.
Philippi
Thomas
Davis
West
WESTON
R.
Parsons
River
Belington
Dry Fk.
Buckhannon
Norton
ELKINS
Middle
Buckhannon
Fk.
Dailey
Huttonsville
Shavers
N
LEGEND
Areas of Circles Proportional to Population Equivalent of Wastes
Before Treatment
As Discharged
Radii
Population Equivalent
500000
400000
300000
200000
100000
50000
25000
10000
2500
500

Fig. Mo-1

MONONGAHELA BASIN

SOURCES OF POLLUTION

10 0 10 20
SCALE OF MILES

OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941

Fig. Mo-1

MONONGAHELA RIVER BASIN

Syllabus and Conclusions

Syllabus

The Monongahela River drains about 7,380 square miles in Pennsylvania, West Virginia and a small section of Maryland. The area is rugged and includes a number of large cities and an important coal mining industry. The main stream is extensively used for navigation. Flood-control reservoirs on Tygart (operated since 1938) and Youghiogheny (under construction) Rivers are used also to increase minimum flows. The distinguishing characteristic of this basin is the high acidity of the streams due to coal mine drainage. Almost half of the basin's total organic pollution load enters in the lower 15.6 miles. Surface water is used as a source of all major water supplies. The high acidity of the stream has served as a deterrent to the abatement of organic and bacterial pollution and the amount of sewage treated is negligible. With sewage treatment and no acid control, the streams would be suitable for only limited use. Damage caused by mine drainage is substantial and the demonstrated success of acid control at the mine by sealing has indicated a promising line of attack. Flow regulation is a valuable supplementary control measure. A mine sealing - flow regulation acid control program for the area above the Ohio - West Virginia - Pennsylvania line is summarized in the Acid Mine Drainage section of the report.

Conclusions

(1) Of 153 water supplies, 98, including all of the larger supplies, are from surface sources. Acidity from coal mine drainage presents corrosion and water treatment problems at the major supplies.

(2) Sewage from 862,000 people, industrial waste equal to the sewage from an additional 426,000 people and 646,000 tons of mine acid per year or about 1,770 tons per day enter the streams of the basin. Of the combined organic pollution load, 49 percent enters the stream in the lower 15.6 miles below the Youghiogheny River. Municipal sewage treatment reduces the total pollution load from 1,288,500 to 1,254,700, about 2.6 percent.

(3) Laboratory data indicate that the major problem is one of acid mine drainage rather than one of organic pollution. However, at the time of sampling, organic pollution appeared to be a factor at Clarksburg and Weston, West Virginia, and Mt.Pleasant, Waynesburg, Jeannette (industrial waste) and Greensburg (one outlet), Pennsylvania.

(4) The original acid load from mine drainage is estimated at 920,000 tons per year (to phenolphthalein-hot), of which 274,000 tons per year or nearly 30 percent has been removed by sealing, leaving 646,000 tons per year. The acid concentration of 87.5 tons per square mile per year in this basin is greater than in any other major Ohio River tributary basin.

(5) A program for acid reduction involving mine sealing supplemented by flow regulation is outlined in the section of the report on Acid Mine Drainage. Expenditures to date for mine sealing in this basin are estimated at $1,820,000. The next step in the mine sealing program is completion of sealing of mining areas not connected to active ventilation systems at mines where sealing costs will not exceed $10.00 per ton of acid sealed per year. Estimated costs of this program total $1,600,000.

(6) Acid conditions can be further improved and mine sealing supplemented by flow regulation from a storage of 370,000 acre-feet in the Monongahela Basin.

(7) The free acid from waste pickle liquor from the steel industry exclusive of acid iron salts totals 23 tons per day or only 1.6 percent of the mine acid load. Iron salts increase the acid effect to some extent. Cost estimates include part time treatment of these wastes and this expenditure will be justified after success is attained in reducing mine acid.

(8) The problem of municipal sewage treatment at Pittsburgh is discussed in the section of the report on the main Ohio River. Low-flow regulation from reservoirs in the Monongahela River basin will be of value in reducing treatment costs, notably at Pittsburgh and Cincinnati.

(9) Justification for treatment and the degree of treatment of sewage and organic industrial waste in many cases is dependent upon the status of mine acid reduction measures. The situation varies with the degree of acidity of the stream and the amount of organic pollution discharged. At some places the need for waste treatment is urgent and at others the first expenditures of public funds can be made to best advantage toward furthering the acid reduction program. In general, cost estimates apply to a comprehensive program that will be justified in parallel with extensive acid control measures.

(10) In conjunction with an effective acid control program, primary treatment is indicated at the cities along the Monongahela River to improve conditions at the sewer outfalls by eliminating floating matter and preventing sludge deposits, and to protect the many downstream public water supplies. In some instances the need is urgent regardless of acid control.

(11) At Elkins, Clarksburg and Weston, West Virginia, acidity is low and secondary treatment appears justified regardless of the status of an acid control program. At Greensburg, Uniontown and a number of additional smaller communities on highly acid streams, secondary treatment will ultimately be required but primary treatment, now installed at Uniontown, is all that is justified in the absence of acid control.

(12) Cost estimates of remedial measures, exclusive of mine sealing and reservoir construction and exclusive of the Pittsburgh district are given in Table Mo-1. These costs are based on treatment justified with a parallel program of acid control. Lack of an acid control program will greatly limit possible stream restoration. Table Mo-1 is summarized as follows:

Treatment	Capital Cost	Annual Cost
Existing	$1,500,000	$ 115,000
Suggested additional	13,250,000	1,455,000

Estimated additional costs, over existing charges, of programs involving uniform treatment throughout the basin, are:

Primary, all places	12,710,000	1,385,000
Secondary, all places	15,950,000	1,785,000

Table Mo-1 Monongahela River Basin - Estimated Cost of Existing and Suggested Minimum Corrective Measures for Sewage and Industrial Wastes, with Comparative Costs for Primary and Secondary Treatment.

	Number of Plants Prim.	Sec.	Population Connected to Sewers	Capital Investment (Dollars)	Annual Charges (Dollars) Amort. & Interest	Operation & Main.	Total
Existing Sewage Treatment	13	7	66,100	1,500,000	90,000	25,000	115,000
Suggested Minimum Correction							
Sewage Treatment Plants	66	16	776,200	6,270,000	440,000	270,000	710,000
Required Interceptors	76			5,870,000	275,000	-	275,000
Independent Industrial Waste Correction				1,110,000	150,000	320,000	470,000
Total				13,250,000	865,000	590,000	1,455,000
Comparative Cost							
Primary Treatment All Waste				12,710,000	830,000	555,000	1,385,000
Secondary Treatment All Waste				15,950,000	1,055,000	730,000	1,785,000
As Suggested				13,250,000	865,000	590,000	1,455,000

NOTE: Costs shown above do not include the cost of interceptors or treatment works for the city of Pittsburgh or its suburbs whose wastes would probably be treated at a plant along the Ohio River.

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Description

The Monongahela River originates in northern West Virginia at the confluence of the Tygart and West Fork Rivers, and flows in a northerly direction to Pittsburgh, Pennsylvania, where it joins the Allegheny River to form the Ohio River. The drainage basin comprises a total of 7,380 square miles, of which 57 percent is in West Virginia, 38 percent is in Pennsylvania and 5 percent is in Maryland. The basin lies entirely in the Appalachian Plateau region and is characterized by rugged topography with narrow stream valleys several hundred feet below the level of the uplands. Most of the cities are in the valleys. Populations exclusive of Pittsburgh proper but including the Monongahela Basin portion of Allegheny County are as follows:

	Populations - 1940		
State	Urban	Rural	Total
West Virginia	107,154	241,028	348,182
Pennsylvania	477,977	423,869	901,846
Maryland	0	14,646	14,646

	Populations			
Larger Cities	1910	1920	1930	1940
Clarksburg, W.Va.	9,201	27,869	28,866	30,579
Fairmont, W.Va.	9,711	17,851	23,159	23,105
Duquesne, Pa.	15,727	19,011	21,396	20,693
McKeesport, Pa.	42,694	46,781	54,632	55,355
Wilkinsburg, Pa.	18,924	24,403	29,639	29,853
Uniontown, Pa.	13,344	15,692	19,544	21,819
Monessen, Pa.	11,775	18,179	20,268	20,257
Pittsburgh, Pa.	- Not included -			
Total Basin				
Urban	346,843	479,903	578,209	585,131
Rural	564,933	614,437	646,575	679,543
Total	911,776	1,094,340	1,224,784	1,264,674

Major Tributaries	River Mile	Drainage Area (Square Miles)
Youghiogheny River	15.6	1,768
Cheat River	89.1	1,424
Tygart River	128.1	1,369
West Fork River	128.1	882

Resources - Natural resources of the basin consist of tillable land, coal deposits and water power.

Industries - Most important of the industries is the mining of coal, followed by the production of steel. Other industries include breweries, distilleries, meat and dairy plants and chemical works.

Water Uses - The Monongahela is canalized for its entire length by fourteen low lift locks and dams which provide navigable depths of eight feet throughout the lower 90 miles and seven feet for the remaining 38 miles. This river is one of the most intensively used inland waterways in the world. Three artificial reservoirs are intensively used for recreation as are many clean streams in the eastern part of the basin. Two large hydroelectric projects, on tributary streams, have been constructed by private interests.

Presentation of Field Data

Figure Mo-2 shows graphically the main stream and tributaries, waterworks intakes, dams, all major sources of organic pollution, their magnitude and reduction by present treatment and other pertinent information. This figure does not show pollution of inorganic origin such as acid mine drainage, pickle liquor or chemical wastes. Selected laboratory data on the main Monongahela and West Fork Rivers also are shown.

Public Water Supplies - Of 153 public water supplies, 5 are in Maryland, 90 in Pennsylvania and 58 in West Virginia. Table Mo-2 shows a total of 98 surface supplies serving 811,200 persons, 37 in Pennsylvania and 20 in West Virginia from streams below community sewer outfalls. There are 55 ground water supplies serving 67,000 persons, indicating that surface sources are used as major supplies. The acidity of surface waters presents unusual problems in treatment and corrosiveness. On the main stream 20 surface supplies have an average pH of 4.0 to 5.0 in the raw water.

Sewerage - Of the 145 sewered communities in the basin, 13 have primary and 7 secondary treatment for their domestic sewage. Treatment serves only about 8 percent of the total sewered population and reduces the total organic pollution load about 2.6 percent. Table Mo-3 summarizes the sources of significant organic pollution including industrial wastes expressed as equivalent sewered population.

Industrial Wastes - Table Mo-4 summarizes pertinent information on waste producing industries in the basin. The coke by-product industry produces by far the largest organic pollution load. Distilling and brewing also produce significant organic waste loads. About one-third of the industries discharge all or part of their industrial waste to city sewer systems. Only one industrial waste receives treatment at a municipal treatment plant. Twenty-six industrial plants have taken at least minor corrective measures to reduce pollution, twenty of these being of an important and effective nature.

Metal industries are important chiefly because of pickle liquor discharges. In the Monongahela River Basin, free acid discharge from this source is estimated at 57,000 pounds or over 28 tons per day. This is only 1.6 percent of the mine

Table Mo-2 Monongahela River Basin - Surface Water Supplies

Supply	State	Source	Mile (1)	Treat-ment (2)	Population Served	Cons. M.G.D.
Supplies Below Community Sewer Outfalls						
S.Pittsburgh W.Co.	Pa.	Monongahela R.	4.0	LD	250,000	18.00
Braddock	"	" "	10.5	LD	18,300	1.30
McKeesport	"	" "& Youghiogheny	16.6	LD	64,000	6.00
Elizabeth	"	Monongahela R.	23.0	FD	30,000	2.60
Charleroi	"	" "	42.5	FD	40,000	1.51
Trotter Water Co."C"	"	" "	77.1	FD	15,000	1.60
Morgantown	W.Va.	" -Impounded	103.0	FZD	30,000	1.25
Uniontown	Pa.	Youghiogheny & Impounded	61.5	FD	30,000	1.60
Trotter Water Co."A"	"	Youghiogheny	62.0	FD	12,000	2.00
Connellsville	"	" & Creeks	62.1	FD	16,000	2.00
Fairmont	W.Va.	Tygart River	128.4	FD	30,000	2.29
Grafton	"	" "	150.0	FD	4,000	1.50
Elkins	"	" "	210.0	FD	8,500	1.14
Clarksburg	"	W. Fork River	160.0	FZD	35,000	2.90
28 Smaller Supplies	Pa.	Various	-	Various	81,000	3.46
15 " "	W.Va.	"	-	"	20,800	1.23
Total - Below Sewer Outfalls					684,300	50.38
Other					126,900	9.04
Total - Surface Water Supplies					811,200	59.42

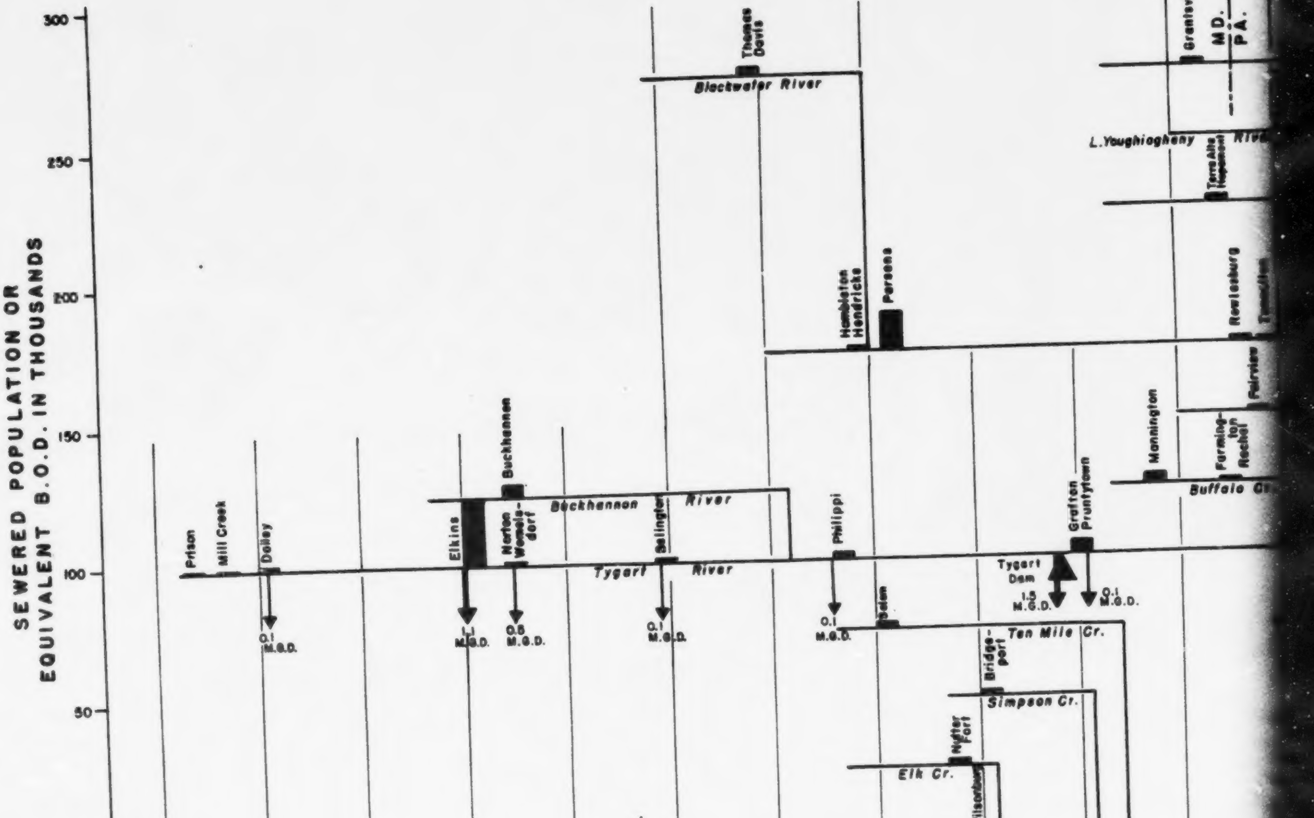
(1) Miles above mouth of Monongahela River.
(2) F - Coagulated, settled, filtered; L - Lime-soda softened; Z - Zeolite softened; D - Chlorinated.

Table Mo-3 Monongahela River Basin - Sources of Significant Pollution Including Industrial Waste Expressed as Sewered Population Equivalent (B.O.D.)

Municipality	State	Receiving Stream	Miles Above Mouth of Monongahela	Population Connected to Sewers	Treatment	Sewered Population Equivalent (B.O.D.)	
						Untreated	Discharged
Pittsburgh(3) (1)	Pa.	Monongahela River	0-10	319,500	None	458,500	458,500
Braddock (1)	"	" "	10.5	32,600	"	32,600	32,600
Duquesne (1)	"	" "	12.0	21,100	"	21,100	21,100
McKeesport	"	" "	14.2	55,000	"	61,700	61,700
Glassport	"	" "	18	8,700	"	8,700	8,700
Clairton	"	" "	20	16,000	"	156,000	156,000
Monongahela City	"	" "	31.9	7,800	"	7,800	7,800
Donora	"	" "	36.4	13,000	"	13,000	13,000
Monessen	"	" "	40.0	18,000	"	18,000	18,000
Charleroi	"	" "	42	10,500	"	10,500	10,500
Brownsville	"	" "	56	7,000	"	7,000	7,000
Masontown	"	" "	79.1	3,000	"	3,000	3,000
Morgantown	W.Va.	" "	100.9	16,100	"	16,100	16,100
Fairmont	"	" "	126.7	20,000	"	27,500	27,500
East Pittsburgh	Pa.	Turtle Creek	12.0	17,300	"	17,300	17,300
Turtle Creek	"	" "	12.5	9,600	"	9,600	9,600
Wilmerding	"	" "	14.0	5,500	"	5,500	5,500
Pitcairn	"	" "	15.5	6,100	"	6,100	6,100
Trafford	"	" "	16.5	3,600	"	3,600	3,600
Irwin	"	" "	24.0	3,400	"	3,400	3,400
Jeannette	"	" "	29	14,500	Secondary	14,500	2,200
Port Vue	"	Youghiogheny R.	16.6	3,600	None	3,600	3,600
Connellsville	"	" "	60	12,900	"	14,300	14,300
Ruffsdale	"	Sewickley Creek	49	0	"	3,100	3,100
S. W. Greensburg	"	" "	55	3,000	"	3,000	3,000
Greensburg	"	" "	56	16,000	"	16,400	16,400
Scottdale	"	Jacobs Creek	54	6,300	"	6,300	6,300
Mt. Pleasant	"	" "	60	5,000	"	5,600	5,600
Somerset	"	Casselman River	118	5,400	Primary	11,100	9,400
Large	"	Peters Creek	23.5	0	None	90,000	90,000
Uniontown	"	Redstone Creek	73	25,000	Primary	27,000	17,500
Waynesburg	"	Ten Mile Creek	85	4,500	"	4,500	2,900
Parsons	W.Va.	Cheat River	167.5	2,000	None	12,900	12,900
Mannington	"	Buffalo Creek	142	3,100	"	3,100	3,100
Grafton	"	Tygart River	150	3,800	"	3,800	3,800
Elkins	"	" "	209	8,100	"	23,100	23,100
Buckhannon	"	Buckhannon River	205	4,300	"	4,300	4,300
Clarksburg	"	West Fork River	158.8	29,000	"	29,000	29,000
Weston	"	" " "	194	5,000	"	5,000	5,000
Smaller (2) Sources (108)				116,900	Various	120,900	93,000
Total - Pennsylvania				727,800		1,120,300	1,089,900
West Virginia				131,400		165,200	161,800
Maryland				3,000		3,000	3,000
Total Basin				862,200		1,288,500	1,254,700

(1) Includes waste from adjoining communities that reaches same outfall sewers.
(2) Excluding places of under 500 population or equivalent.
(3) Pollution loads from Pittsburgh and Suburbs are distributed to Allegheny and Monongahela Basins and Main Ohio River as follows:

Pittsburgh and Suburbs	Pa.	Allegheny River	0-8	320,500	None	597,200	597,200
	"	Monongahela River	0-10	319,500	"	458,500	458,500
	"	Ohio River	0-4(below)	261,700	"	278,600	278,600
Total	-	-	-	901,700	-	1,334,300	1,334,300



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OHIO RIVER POLLUTION SURVEY
U.S. PUBLIC HEALTH SERVICE
1941

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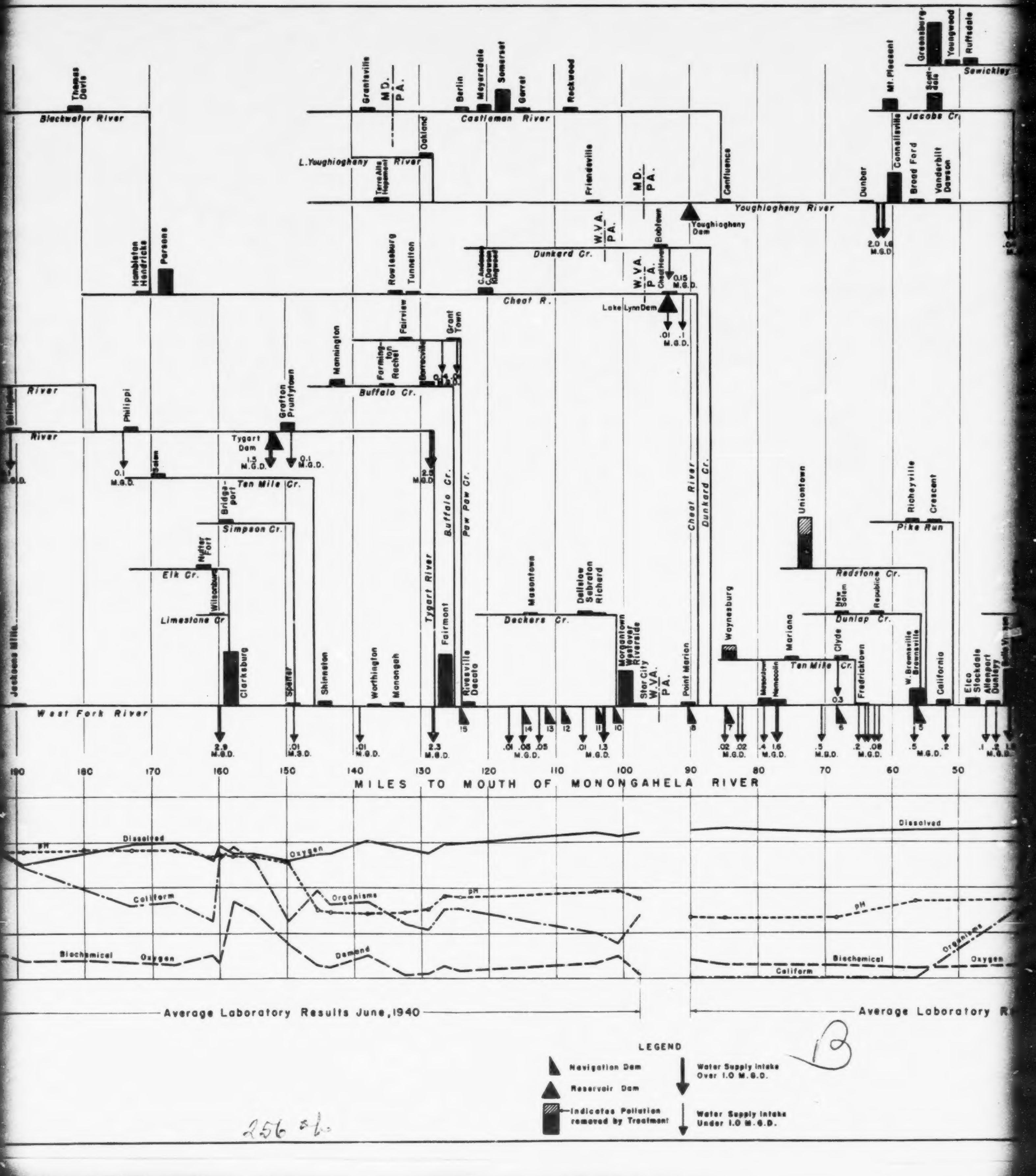
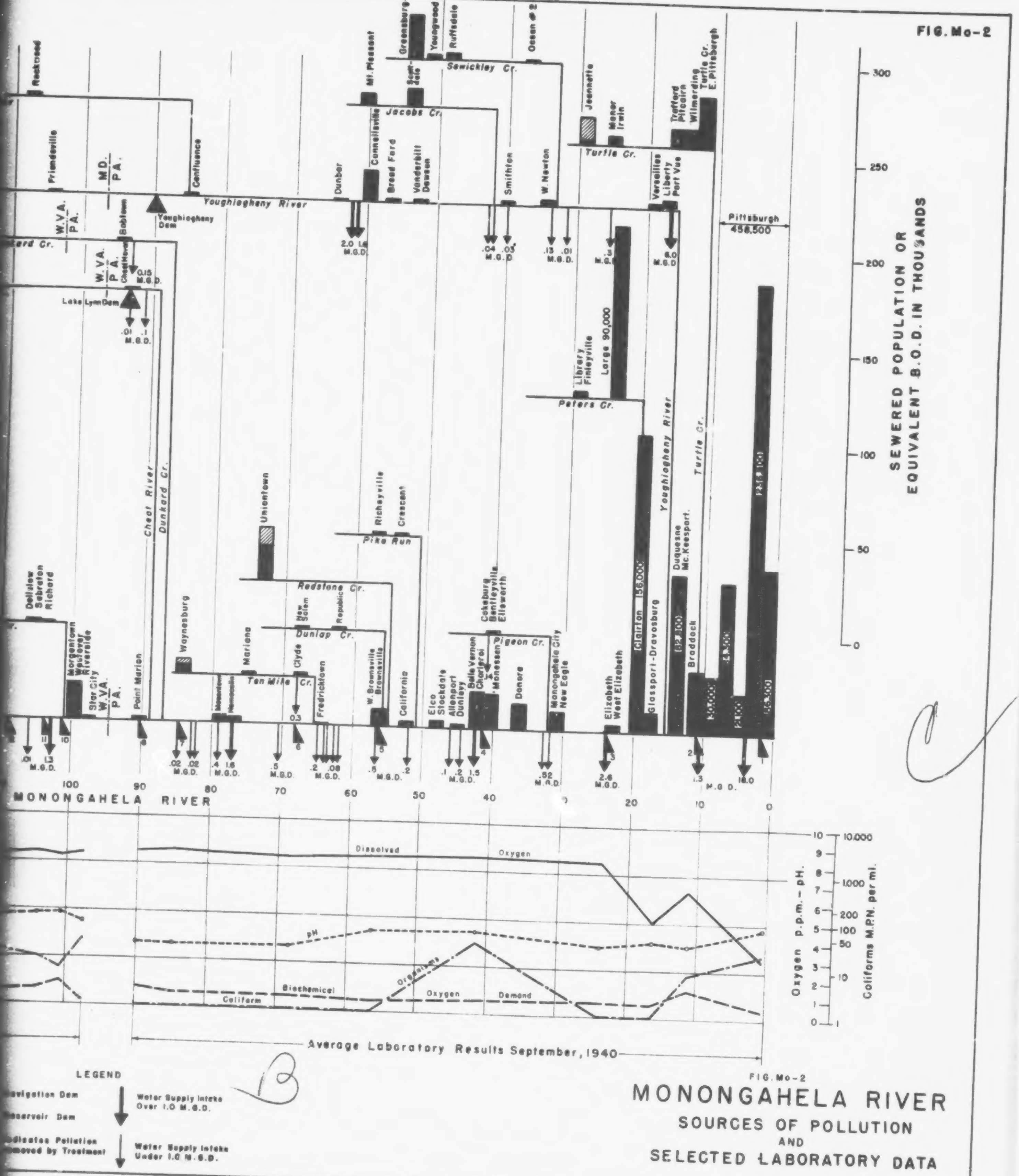

Thomas
Davis
Blackwater River
Hambleton
Hendricks
Parsons
Cheat R.
Grantsville
MD.
PA.
Berlin
Meyersdale
Somerset
Garret
Rockwood
Casselman River
L. Youghiogheny River
Oakland
Terra Alta
Friendsville
Confluence
Youghiogheny River
Youghiogheny Dam
Dunbar
Connellsville
Broad Ford
Vanderbilt
Dawson
2.0
1.6
M.G.D.
Mt. Pleasant
Scottdale
Jacobs Cr.
Greensburg
Youngwood
Ruffsdale
Sewickley
W.VA.
PA.
Bobtown
Dunkard Cr.
C. Andrews
Kingwood
Rowlesburg
Tunnelton
Cheat Haven
0.15
M.G.D.
Lake Lynn Dam
.01
.1
M.G.D.
Mannington
Fairview
Farmington
Rachel
Barrackville
Grant Town
Buffalo Cr.
River
Philippi
Grafton
Pruntytown
Tygart Dam
1.5
M.G.D.
0.1
M.G.D.
0.1
M.G.D.
Salem
Ten Mile Cr.
2.3
M.G.D.
Bridgeport
Simpson Cr.
Nutter Fort
Elk Cr.
Wilsonburg
Limestone Cr.
Tygart River
Buffalo Cr.
Paw Paw Cr.
Cheat River
Dunkard Cr.
Uniontown
Richeyville
Crescent
Pike Run
Redstone Cr.
New Salem
Republic
Dunlap Cr.
Masontown
Dellslow
Sabraton
Richard
Deckers Cr.
Morgantown
Westover
Riverside
Star City
W.VA.
PA.
Waynesburg
Mariana
Ten Mile Cr.
Clyde
Fredericktown
W. Brownsville
Brownsville
California
Elco
Stockdale
Allenport
Dunlevy
Jacksons Mills
Clarksburg
Spelter
Shinnston
Worthington
Monongah
Fairmont
Rivesville
Decota
Point Marion
Maxwell
Nemacolin
West Fork River
2.9
M.G.D.
.01
M.G.D.
.01
M.G.D.
2.3
M.G.D.
15
14
13
12
11
10
.01
.08
.05
M.G.D.
.01
1.3
M.G.D.
8
7
.02
.02
M.G.D.
.4
1.6
M.G.D.
.5
M.G.D.
6
03
.2
.08
M.G.D.
5
.5
.2
M.G.D.
.1
.2
1.9
M.G.D.
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
MILES TO MOUTH OF MONONGAHELA RIVER
pH
Dissolved
Oxygen
Coliform
Organisms
pH
Biochemical
Oxygen
Demand
Dissolved
pH
Organisms
Biochemical
Oxygen
Coliform
Average Laboratory Results June, 1940
Average Laboratory R
LEGEND
Navigation Dam
Reservoir Dam
Indicates Pollution removed by Treatment
Water Supply Intake Over 1.0 M.G.D.
Water Supply Intake Under 1.0 M.G.D.

13

256 ab

FIG. Mo-2



B

C

FIG. Mo-2

MONONGAHELA RIVER
SOURCES OF POLLUTION
AND
SELECTED LABORATORY DATA

Table Mo-4 Monongahela River Basin - Summary of Industrial Wastes not Discharging to Municipal Treatment Plants with Total of Entire Industrial Waste Load in the Basin.

Industry	Number of Plants	Industrial Waste Disposal		At Least Minor Corrective Measures Taken	Estimated Sewered Population Equivalent (B.O.D.)
		Munic. Sewers	Private Outlet		
Brewing	5	4	1	0	49,100
By-Product Coke	3	0	3	2	240,000
Chemical	3	0	3	0	-
Distilling	3	0	3	2	94,000
Meat	6	4	2	4	6,100
Milk	5	3	2	2	3,300
Steel	26	4	22	12	-
Tanning	2	0	2	2	25,000
Textile	2	0	2	0	1,000
Miscellaneous	31	6	25	2	5,800
Wastes Unconnected Munic. Treatment	86	21	65	26	424,300
Waste Discharged to Municipal Treatment					2,000
Total Industrial Waste in the Basin					426,300
By States - Maryland					0
Pennsylvania					392,500
West Virginia					33,800

acid load. Acid iron salts, having an acid effect, are not included in this figure and the comparison, although the best that can be made from the data available, involves acid figures which are not strictly comparable. However, it is apparent that acid mine drainage is by far the more important problem.

Mine Drainage - Acid mine drainage discharge in this basin has the greatest intensity in annual tons per square mile of all the major tributary basins of the Ohio River. Estimated acid loads as presented in the Acid Mine Drainage section of the Ohio River Pollution Survey Report are as follows:

Description	Monongahela River except Youghiogheny	Youghiogheny River Only	Total Monongahela River
Original Acid Load:	Tons per year (to Phenolphthalein - Hot)		
Active Mines	438,274	141,735	580,009
Marginal Mines	39,064	25,609	64,673
Abandoned Mines	223,634	52,340	275,974
Total	700,972	219,684	920,656
Per Square Mile	124.1	126.8	124.7
Sealed Mines	380,026	29,270	409,296
Removed by Sealing	251,900	22,742	274,642
Present Load	449,072	196,942	646,014
Per Square Mile	79.5	113.7	87.5
Additional Removal (1)	115,630	83,050	198,680
Future Residual (2)	333,442	113,892	447,334
Per Square Mile	59.0	65.8	60.6

(1) Economical to remove in addition by sealing under 1940 restrictions with a cost limitation of $10.00 per ton of acid per year and sealing only in areas not connected to active ventilation systems.

(2) Capable of further reduction (possibly an additional 50 percent) by extended program.

Presentation of Laboratory Data

Complete summaries of routine laboratory results for the Monongahela River Basin are presented in Table Mo-7. Summaries of special acid and chemical determinations are shown in Table Mo-7A. These data were obtained in part from operations of mobile laboratories connected with the present survey and in part from the West Virginia State Water Commission. Observations were carried out during the period May to December 1940.

Selected average analytical results at some of the principal points in the basin are tabulated with stream flows on sampling days and with the minimum flows of record in Table Mo-5. Selected results have been chosen for low dissolved oxygen, high coliform or low pH findings and, in general, represent the most unfavorable conditions during the sampling period. Selected average acid and chemical results are presented in Table Mo-5A.

Figures Mo-3, Mo-4, Mo-5 and Mo-5A show graphically the concentration of coliform organisms, dissolved oxygen, oxygen demand and pH, respectively, at various sampling points throughout the watershed. These data are presented as averages of all the results where the sampling period was less than a month and as the most unfavorable monthly averages where observations extended over more than one month.

Stream discharges on the Monongahela varied from 62,000 second-feet in May to 830 second-feet in August at mile 85. During the May-July period, flows in the West Fork River at Clarksburg were 800 to 1,000 second-feet and the Tygart River discharges during the sampling period in June at Grafton were about 5,000 second-feet. Discharges from August to December were generally in the normal low-water ranges.

It appears, from an examination of the laboratory data, that the main problem in the Monongahela Basin is one of acid mine drainage rather than one of organic pollution. Organic pollution appeared to be a factor at Jeannette, Greensburg, Mt. Pleasant and Waynesburg, Pennsylvania, and East Salem, Clarksburg and Weston, West Virginia. Of these, Waynesburg has a sewage treatment plant under construction. The Cheat and Tygart Rivers were in generally good sanitary condition during the sampling period.

As indicated by bacteriological findings, about 71 percent of the sampling stations above towns on normal streams (85 percent on acid streams) showed coliform organism concentrations of less than 200 per ml. The effect of acid stream conditions, as compared to normal stream conditions was, in general, to reduce the coliform counts.

The dissolved oxygen results show quite general average concentrations of 6.5 p.p.m. or more and 78 percent of all stations in the basin fall into this group. Oxygen depletion was observed only below Jeannette, Pennsylvania in October and near depletion below Waynesburg, Pennsylvania in August. pH values were above 7.0 at both points.

Over 70 percent of all stations had average oxygen demands of less than 3.0 p.p.m. under the most unfavorable conditions observed. About [illegible] percent of all stations sampled had oxygen demands in [illegible] 5.0 p.p.m. Because of the effect of acid on normal biochemical oxidation, the B.O.D. tests on acid stream samples were carried out in duplicate; one portion being incubated in the acid state as collected and the other being incubated after neutralization with sodium hydroxide and seeding with filtered sewage. In general, the results of the two portions were either of the same order of magnitude or the acid portion showed a higher B.O.D., in a few cases a great deal higher, than the neutralized portion. Ferrous iron may exert a chemical demand to further complicate interpretation.

The results of acid stream examinations on Table Mo-7A show pH values ranging from 2.8 to 6.9, acidities from nearly zero to about 5,000 p.p.m., and total iron from less than 1.0 p.p.m. to over 2,000 p.p.m.

The presence of acid wastes makes the interpretation of much of the sanitary data gathered along the Monongahela Basin somewhat difficult and complicates the evaluation of the effects of the self-purification process. There was a general tendency for the acidity to decrease with increased stream discharge. This appeared to be the case both on the larger and the smaller streams. Increased stream discharges also tended to increase the coliform and dissolved oxygen concentrations and to decrease the oxygen demands in the smaller streams but apparently had little effect, so far as these factors are concerned, on the larger streams in the discharge ranges observed.

Biological Summary - The acid condition of the main stream of the Monongahela renders it nearly devoid of plankton or fish life, except where clean tributaries join the main stream. The tributaries, Ten Mile Creek and Pigeon Creek, support a fair plankton and fish population.

Table Mo-5 Monongahela River Basin - Selected Laboratory Data

River Location	Mouth Pittsburgh	Dam #2 Pittsburgh	Above Youghiogheny	Dam #3 McKeesport	Dam #4 Charleroi	Dam #5 Brownsville	Dam #6
River Miles Above:							
Mouth of Monongahela	.05	11.2	16.4	23.8	41.5	56.5	68.3
Period - 1940	Sept.	Aug.	Aug.-Sept.	Sept.	Aug.	Aug.	Sept.
Number of Samples	2	2	4	1	2	2	4
Flow in c.f.s.:							
Sampling Days	2,140	3,200	1,600	2,100	1,340	1,170	1,570
Minimum Month	398	-	249	-	-	-	-
Water Temperature °C.	22	22	23.8	22	24.2	24.3	21.1
Coliforms per ml.	27	23	1	*	1	3	*
Dissolved oxygen ppm.	3.0	5.7	5.0	8.1	7.8	7.6	8.0
B.O.D.,5-day,p.p.m.	2.1	0.7	0.8	0.9	0.9	0.5	0.8
pH	4.7	3.9	4.0	3.7	3.3	3.6	3.6

River Location	Dam #7	Dam #8 Pt.Marion	Star City	Morgantown, W.Va.	Lock #11 Morgantown	Below Fairmont	Fairmont
River Miles Above:							
Mouth of Monongahela	84.8	90	97.7	100.9	104.1	124.2	126.7
Period - 1940	Sept.	May	June	June	June	June	June
Number of Samples	4	1	4	4	4	3	3
Flow in c.f.s.:							
Sampling Days	1,090	38,000	6,750	6,700	6,600	4,230	1,787
Minimum Month	-	-	-	-	43	-	-
Water Temperature °C.	21.6	16.0	22.7	22.5	22.7	23.0	23.0
Coliforms per ml.	*	8	25	6	10	34	38
Dissolved oxygen p.p.m.	8.2	9.6	8.0	7.8	8.0	7.0	7.3
B.O.D.,5-day,p.p.m.	1.0	0.8	0.2	1.2	0.8	0.4	0.7
pH	3.4	5.0	4.4	4.9	4.8	4.5	4.6

River Location	Youghiogheny				Casselman near Mouth	Casselman abv. Meyersdale	Cheat near Mouth
	near Mouth	below Connellsville	below Confluence	below Oakland			
River Miles Above:							
Conf.with Monongahela	0.7	31.4	68.9	111.9	71.4	100.4	.9
Mouth of Monongahela	16.3	57	84.5	127.5	87	116	90
Period - 1940	Aug.	Aug.	July	June	July	July	June
Number of Samples	2	1	3	3	3	3	3
Flow in c.f.s.:							
Sampling Days	1,810	2,490	640	299	219	72	13,400
Minimum Month	113	-	-	-	-	-	-
Water Temperature °C.	21.8	19.5	23.8	18.0	22.2	20.5	19.3
Coliforms per ml.	5	2,400	21	48	4	38	11
Dissolved oxygen ppm.	6.7	8.4	7.9	8.2	8.2	7.6	8.6
B.O.D.,5-day,p.p.m.	1.2	2.0	0.6	0.7	0.5	1.3	1.0
pH	3.5	6.7	5.1	5.0	3.8	3.6	5.5

River Location	Cheat R. bel. Holly Meadows	Tygart R. near Mouth	Tygart R. below Grafton	Tygart R. below Elkins	West Fork River		
					near Mouth	below Clarksburg	above Weston
River Miles Above:							
Conf.with Monongahela	76.4	3.9	18.6	77.4	.9	29.9	66.9
Mouth of Monongahela	165.5	132	146.7	205.5	129	158	195
Period - 1940	June	June	June	July	June	June	June
Number of Samples	3	3	3	4	3	3	3
Flow in c.f.s.:							
Sampling Days	2,890	5,220	5,210	472	979	1,057	116
Water Temperature °C.	16.7	19.8	19.5	18.8	24.0	23.0	21.7
Coliforms per ml.	20	23	30	825	12	881	49
Dissolved oxygen ppm.	8.6	9.0	9.6	7.3	6.9	6.9	7.7
B.O.D.,5-day,p.p.m.	0.5	0.5	0.6	1.6	.7	4.4	0.6
pH	6.8	6.7	6.7	6.9	3.8	6.7	7.1

* Less than one.

Table Mo-5A Monongahela River Basin - Selected Laboratory Chemical Data

River Location	Monongahela Mouth	Monongahela abv. Youghiogheny	Monongahela Lock No.4	Monongahela Lock No.6	Monongahela Lock No.8	Monongahela Lock No.11	Monongahela below Fairmont
River Miles Above:							
Mouth of Monongahela	.05	16.4	41.5	68.3	90.6	104.1	124.2
Period - 1940	Oct.	Aug.-Sept	Oct.	Sept.	Nov.	June	June
Number of Samples	4	4	5	4	4	4	3
Flow in c.f.s.:							
Sampling Days	2,710	1,600	1,920	1,570	3,070	6,660	4,230
Minimum Month	398 (1270*)	249 (899*)	-	-	-	43 (713*)	-
pH	3.7	4.0	3.6	3.4	4.3	4.8	4.5
Acidity p.p.m.:							
Methyl Red	26	16	22	34	7	9	14
Phenolphthalein(Hot)	43	37	35	45	15	19	20
Iron total p.p.m.	5	3.2	1.5	1.5	1.7	1.3	1.6

River Location	Youghiogheny Mouth	Youghiogheny bel. Oakland, Md.	Casselman Mouth	Cheat Mouth	Blackwater Mouth	West Fork Mouth	West Fork above Zeising, W.Va.
River Miles Above:							
Mouth of Monongahela	16.3	127.5	87	90	172	129	149.8
Conf.with Monongahela	.7	111.9	71.4	.9	82.9	.9	21.7
Period - 1940	Oct.	June	July	June	June	June	July
Number of Samples	4	2	2	2	2	3	2
Flow in c.f.s.:							
Sampling Days	627	382	385	2,475	625	936	469
Minimum Month	113	-	-	-	-	-	-
pH	3.6	5.3	3.9	5.0	4.8	3.9	5.2
Acidity p.p.m.:							
Methyl Red	45	-	15	16	11	25	17
Phenolphthalein(Hot)	76	14	28	32	22	46	41
Iron total p.p.m.	6.0	4.3	1.2	1.7	3.9	1.4	3.7

* After Tygart Dam installed.

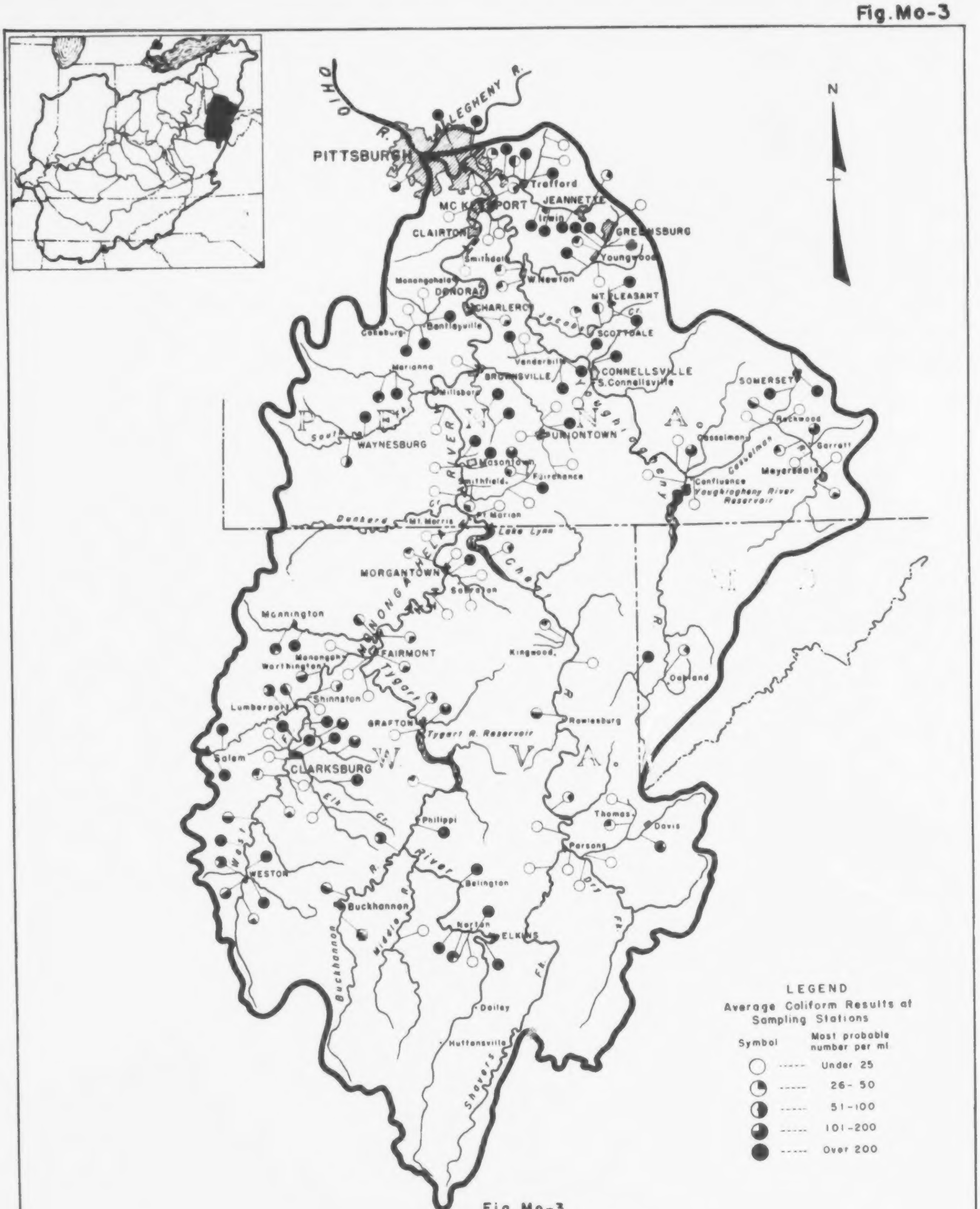

OHIO
ALLEGHENY R.
R.
N
PITTSBURGH
Trafford
MC KEESPORT
JEANNETTE
Irwin
CLAIRTON
GREENSBURG
Smithdale
Youngwood
Monongahela
DONORA
W. Newton
MT. PLEASANT
CHARLEROI
Jacobs
Cr.
SCOTTDALE
Cokeburg
Bentleyville
Vanderbilt
CONNELLSVILLE
S. Connellsville
Marianna
BROWNSVILLE
SOMERSET
Millsboro
PENNA.
South
WAYNESBURG
UNIONTOWN
Rockwood
Casselman
Garrett
Meyersdale
Masontown
Fairchance
Smithfield
Confluence
Youghiogheny River Reservoir
Dunkard
Mt. Morris
Pt. Marion
Lake Lynn
Cheat
MORGANTOWN
Sabraton
MONONGAHELA
Mannington
Monongah
FAIRMONT
Kingwood
Worthington
Tygart
Oakland
Shinnston
Lumberport
GRAFTON
Rowlesburg
Tygart R. Reservoir
Salem
CLARKSBURG
W. VA.
Elk
Cr.
Philippi
Thomas
Davis
West
WESTON
River
Parsons
Belington
Buckhannon
Buckhannon
Middle R.
Norton
ELKINS
Dry
Fk.
Dailey
Huttonsville
Shavers
Fk.
MD.
LEGEND
Average Coliform Results at Sampling Stations
Symbol
Most probable number per ml.
○ ----- Under 25
◔ ----- 26-50
◑ ----- 51-100
◕ ----- 101-200
● ----- Over 200

Fig. Mo-3

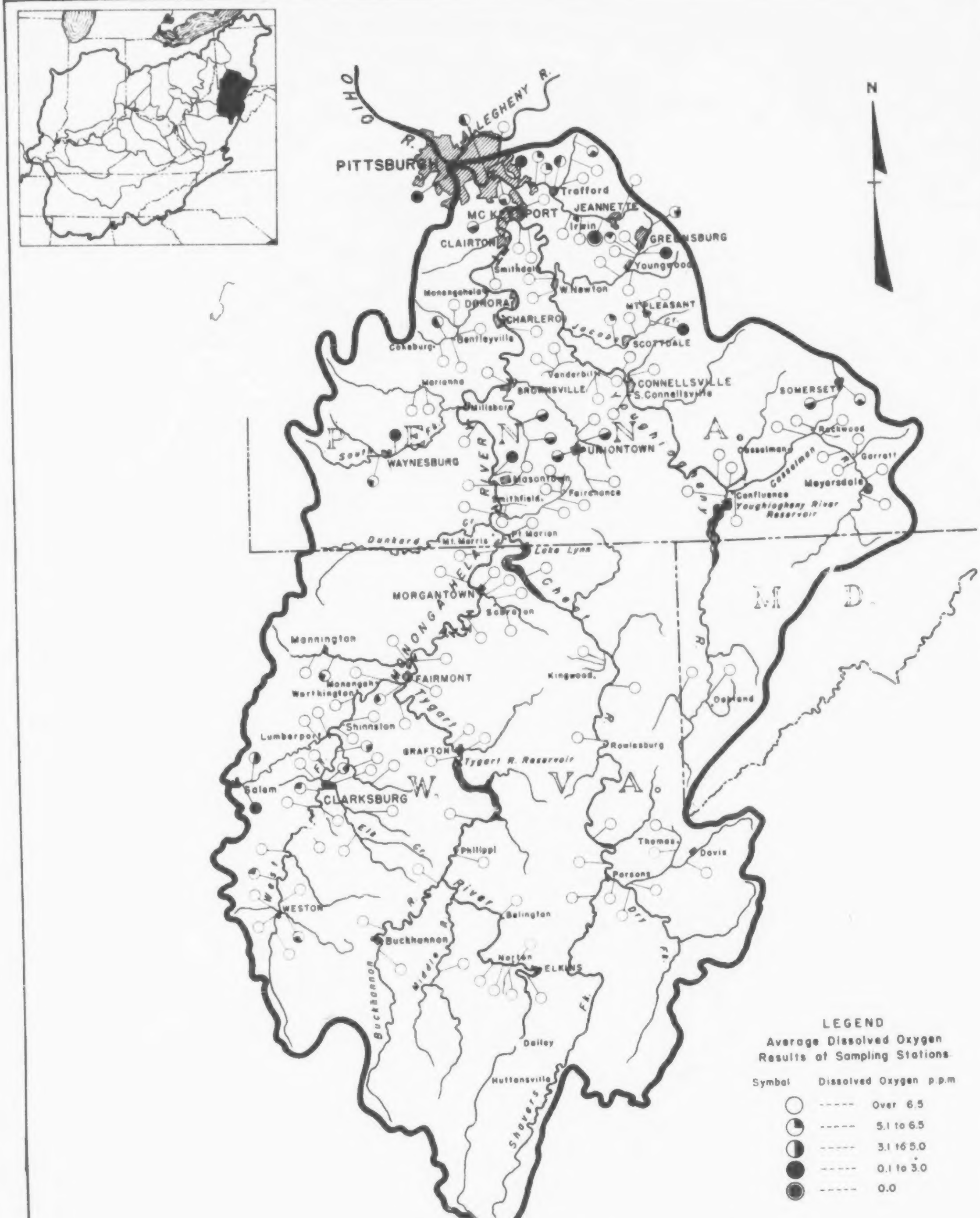
MONONGAHELA BASIN

COLIFORM RESULTS

10 0 10 20
SCALE OF MILES

OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941

Fig.Mo-4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ALLEGHENY R.
PITTSBURGH
Trafford
MC KEESPORT
JEANNETTE
Irwin
GREENSBURG
CLAIRTON
Youngwood
Smithdale
W. Newton
Monongahela
DONORA
MT. PLEASANT
CHARLEROI
Jacobs Cr.
Cokeburg
Bentleyville
SCOTTDALE
Vanderbilt
CONNELLSVILLE
S. Connellsville
Marianna
BROWNSVILLE
SOMERSET
Millsboro
Rockwood
P E N N A.
South Fk.
WAYNESBURG
UNIONTOWN
Casselman
Garrett
Youghiogheny R.
Meyersdale
RIVER
Masontown
Smithfield.
Fairchance
Confluence
Youghiogheny River Reservoir
Cr.
Pt. Marion
Dunkard
Mt. Morris
Lake Lynn
MONONGAHELA
MORGANTOWN
Cheat
Sabraton
M D.
Mannington
Kingwood.
R.
Monongah
FAIRMONT
Worthington
Tygart
Oakland
Shinnston
Lumberport
Rowlesburg
GRAFTON
Tygart R. Reservoir
W. V A.
Salem
CLARKSBURG
Elk Cr.
Thomas
Davis
Philippi
Parsons
West Fk.
River
Dry Fk.
WESTON
Belington
Buckhannon
Middle R.
Norton
ELKINS
Buckhannon R.
Fk.
Dailey
Huttonsville
Shavers
N
LEGEND
Average Dissolved Oxygen
Results of Sampling Stations
Symbol
Dissolved Oxygen p.p.m
○ ----- Over 6.5
◔ ----- 5.1 to 6.5
◑ ----- 3.1 to 5.0
● ----- 0.1 to 3.0
◉ ----- 0.0

Fig.Mo-4

MONONGAHELA BASIN

DISSOLVED OXYGEN RESULTS

10 0 10 20
SCALE OF MILES

OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941

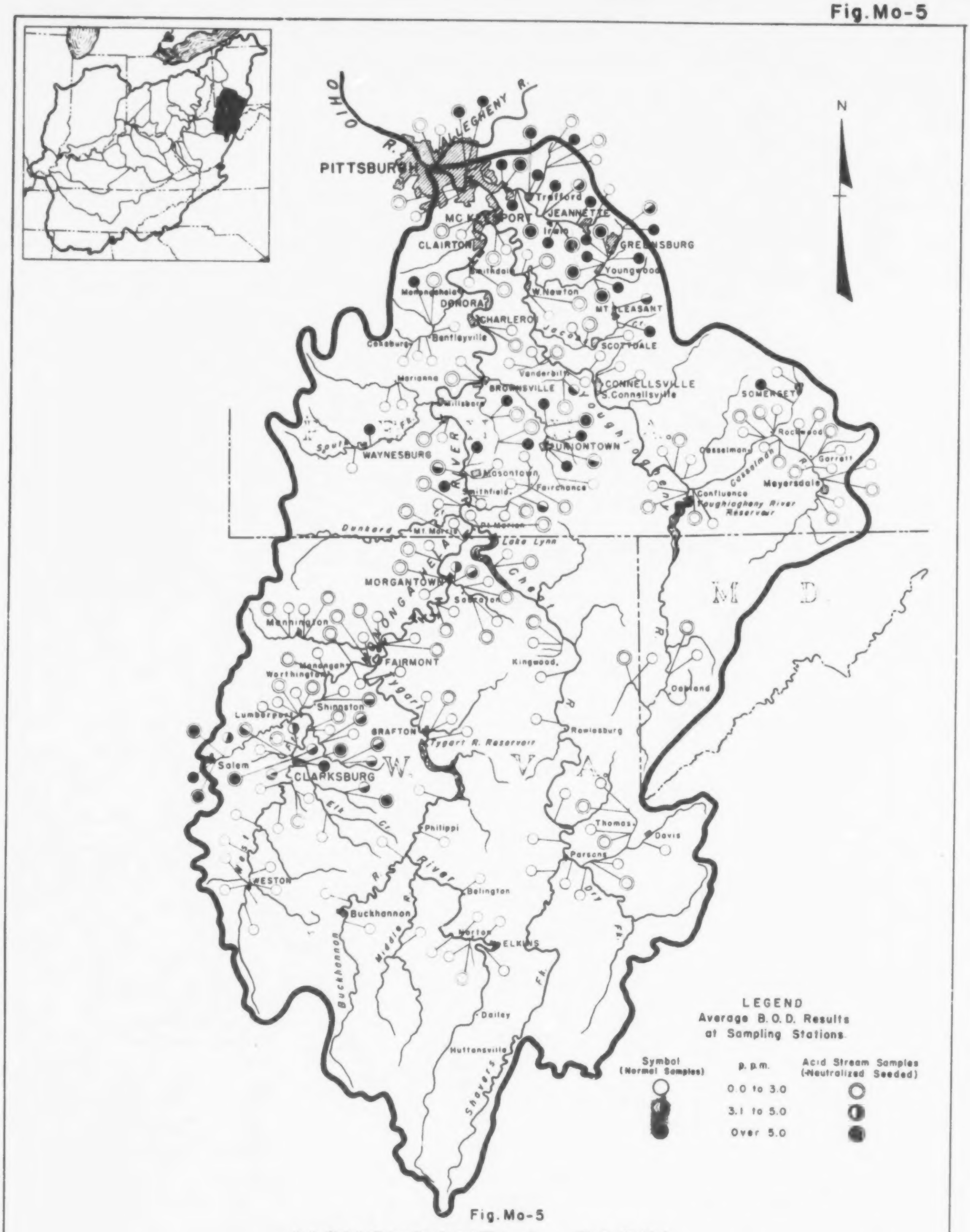

N
OHIO R.
ALLEGHENY R.
PITTSBURGH
Trafford
JEANNETTE
MC KEESPORT
Irwin
GREENSBURG
CLAIRTON
Youngwood
Monongahela
DONORA
W. Newton
MT. PLEASANT
CHARLEROI
SCOTTDALE
Jacobs Cr.
Bentleyville
Cokeburg
Vanderbilt
CONNELLSVILLE
S. Connellsville
Marianna
BROWNSVILLE
SOMERSET
Rockwood
Casselman
Garrett
Meyersdale
Confluence
Youghiogheny River Reservoir
UNIONTOWN
WAYNESBURG
South Fk.
Masontown
Fairchance
Smithfield
Dunkard
Mt. Morris
Pt. Marion
Lake Lynn
MONONGAHELA RIVER
Cheat R.
MORGANTOWN
Sabraton
M. D.
Mannington
Monongah
Worthington
FAIRMONT
Kingwood
Tygart
Shinnston
Lumberport
GRAFTON
Tygart R. Reservoir
Rowlesburg
Oakland
Salem
CLARKSBURG
Elk Cr.
W. VA.
Thomas
Davis
Philippi
Parsons
WESTON
West Fk.
River
Belington
Buckhannon
Buckhannon R.
Middle R.
Norton
ELKINS
Dry Fk.
Dailey
Huttonsville
Shavers Fk.
LEGEND
Average B.O.D. Results at Sampling Stations.
Symbol (Normal Samples)
p.p.m.
Acid Stream Samples (Neutralized Seeded)
0.0 to 3.0
3.1 to 5.0
Over 5.0

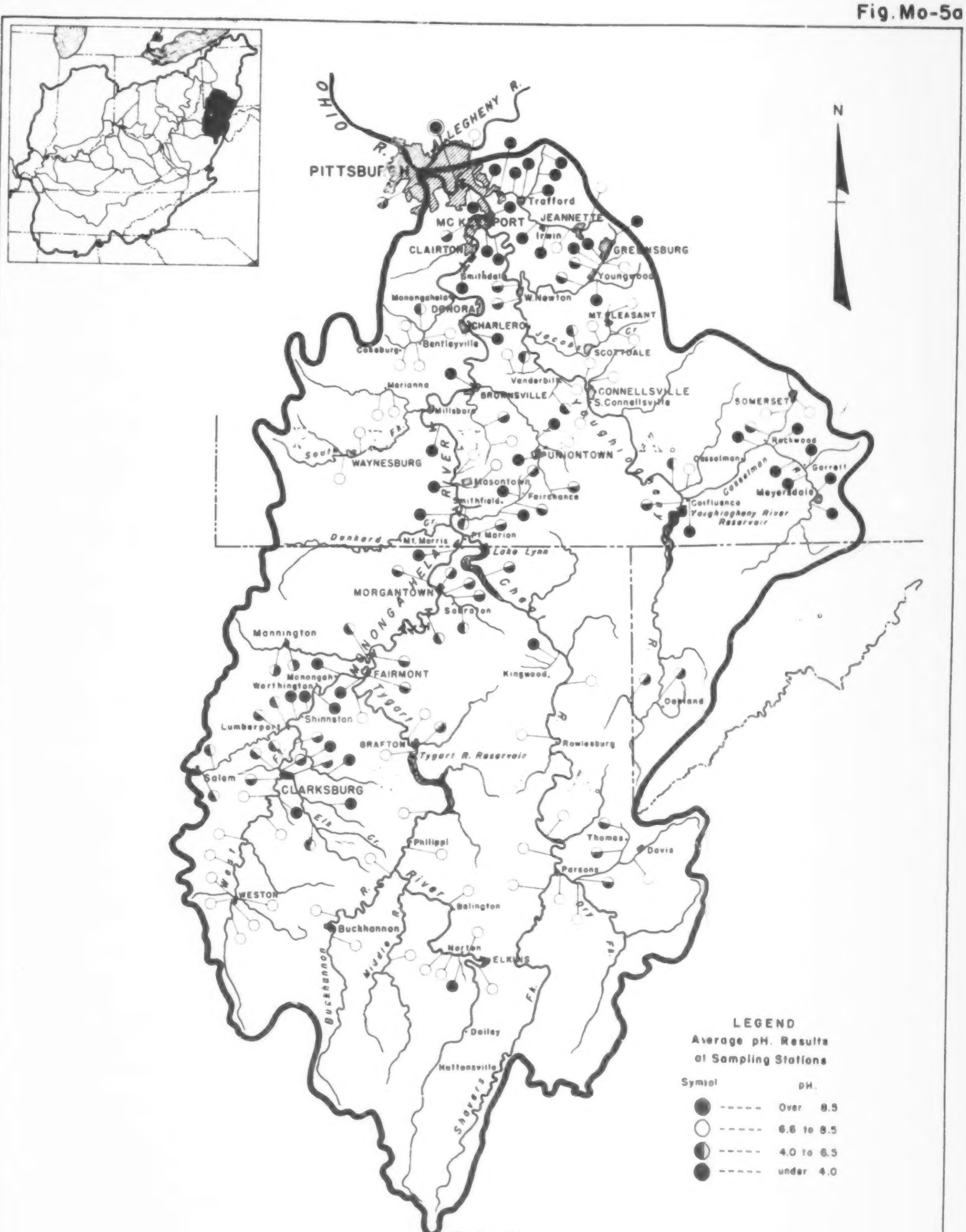
Fig. Mo-5

MONONGAHELA BASIN

BIOCHEMICAL OXYGEN DEMAND

10 0 10 20
SCALE OF MILES

OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941


OHIO R.
ALLEGHENY R.
N
PITTSBURGH
Trafford
JEANNETTE
MC KEESPORT
Irwin
CLAIRTON
GREENSBURG
Youngwood
Smithdale
Monongahela
W. Newton
DONORA
MT. PLEASANT
CHARLEROI
Jacobs Cr.
SCOTTDALE
Cokeburg
Bentleyville
Vanderbilt
Marianna
BROWNSVILLE
CONNELLSVILLE
S. Connellsville
SOMERSET
Millsboro
South Fk.
WAYNESBURG
RIVER
UNIONTOWN
Youghiogheny
Casselman
Rockwood
Garrett
Masontown
Meyersdale
Smithfield
Fairchance
Confluence
Youghiogheny River Reservoir
Dunkard Cr.
Mt. Morris
Pt. Marion
Lake Lynn
Cheat
MORGANTOWN
Sabraton
MONONGAHELA
Mannington
FAIRMONT
Kingwood
Monongah
Worthington
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Shinnston
Lumberport
GRAFTON
Tygart R. Reservoir
Rowlesburg
Salem
CLARKSBURG
Elk Cr.
Philippi
Thomas
Davis
West Fk.
Parsons
WESTON
River
Belington
Dry Fk.
Buckhannon
Buckhannon R.
Middle R.
Norton
ELKINS
Dailey
Huttonsville
Shavers Fk.
LEGEND
Average pH. Results at Sampling Stations
Symbol
pH.
● ----- Over 8.5
○ ----- 6.6 to 8.5
◐ ----- 4.0 to 6.5
● ----- under 4.0

Fig. Mo-5a

MONONGAHELA BASIN

pH. RESULTS

10 0 10 20
SCALE OF MILES

OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941

Hydrometric Data

Twenty-two stream gaging stations with records of consequence have been maintained in the Monongahela River Basin at various times, of which 19 are currently in operation. Table Mo-6 shows monthly mean summer flows at eight stations for three dry summers during the period of record. Flows on the Monongahela River and the lower Tygart River have been affected by Tygart Reservoir completed in 1938. Figure Mo-6 indicates that the frequency with which minimum monthly mean summer flows have occurred and would have occurred with regulation by Tygart and Youghiogheny Reservoirs are as follows:

Regulation Status	Minimum Monthly Mean Summer Flows in cubic feet per second that may be expected once in			
	2 Years	5 Years	10 Years	Minimum
Youghiogheny River at Connellsville, Pa.				
Unregulated	480	270	180	85
Regulated by Youghiogheny Dam	1340	990	800	600
Monongahela River at Charleroi, Pa.				
Unregulated	3150	1300	750	250
Regulated by Tygart Dam	3550	1550	950	400

Low-flow Regulation - There are two private reservoirs of consequence on the basin used for power. Lake Lynn on the Cheat River below the proposed Cheat River reservoir has a capacity of 72,300 acre-feet. Deep Creek reservoir on a headwater stream of the Youghiogheny River has a capacity of 106,000 acre-feet. Both of these reservoirs are operated to produce peak load power and are of limited benefit to the pollution problem. The normal fluctuating flows below peak power reservoirs are undesirable from a standpoint of pollution abatement.

The following reservoirs in the basin have been built, are under construction or have been studied by the U. S. Engineer Department in connection with the authorized program for Ohio River flood control.

Reservoir	Stream	Status	Storage Acre-Feet
Tygart River	Tygart R.	Completed	278,800
Youghiogheny	Youghiogheny R.	Under construction	249,000
Cheat River	Cheat R.	Proposed	890,000
West Fk. above Clarksburg	West Fork	Proposed	61,200
Brownsville	" "	Proposed	101,500
Elk Creek	Elk Creek	Proposed	114,500

The Tygart Reservoir is being operated to provide low-flow control and the Youghiogheny Reservoir will be so operated. The major value to pollution abatement of these reservoirs and of the proposed reservoirs is in supplementing mine sealing for the control of acidity. The value of such flow regulation is discussed in the section of the report on "Acid Mine Drainage." In addition, they could aid in abating pollution in the Ohio River below Pittsburgh due to sewage and other organic wastes. Except for the reservoirs on the West Fork and Elk Creek above Clarksburg, flow augmentation by the proposed projects would have no appreciable tangible value for the abatement of organic pollution within the Monongahela River Basin. The West Fork Reservoir could also be of value in ensuring the adequacy of Clarksburg's public water supply, which suffered a serious shortage in 1930.

Table Mo-6 Monongahela River Basin - Monthly Mean Summer Flows for Years in Which Low Summer Flows have Occurred.

River Location		Monongahela Charleroi Pa.	Turtle Cr. Trafford Pa.	Youghiogheny Connellsville Pa.	Cheat R. Parsons W.Va.
River Miles Above:					
Conf.with Mon. R.		-	5.5	44.4	78.4
Mouth of Mon. R.		42	16.5	60	167.5
Drain. Area Sq.Mi.		5,213	54.8	1,326	719
Period of Record		1933-39	1916-39	1909-39	1913-39
Year		1936	1932	1939	1930
June	c.f.s.	1,345	3.59	1,974	573
July	"	1,337	2.37	1,571	89.3
August	"	2,172	.96	285	34.9
September	"	911	.56*	85.2*	23.3*
Year		1934	1930	1910	1932
June	"	1,009	48.9	5,229	496
July	"	4,296	4.37	575	1,560
August	"	1,501	.95	100	376
September	"	475*	1.22	218	87.9
Year		1939 (1)	1922	1914	1936
June	"	7,488	25.3	1,230	305
July	"	7,471	58.8	536	1,340
August	"	2,280	2.49	323	475
September	"				

(1) Regulated by Tygart Reservoir.

River Location		Cheat R. Pisgah, W.Va.	West Fork Enterprise W.Va.	West Fork Clarksburg W.Va.	Tygart R. Belington W.Va.
River Miles Above:					
Conf.with Mon. R.		18	13.0	30.7	61.9
Mouth of Mon. R.		107.1	141.1	158.8	190
Drain. Area Sq.Mi.		1,360	759	384	408
Period of Record		1928-39	1907-16 1933-29	1923-39	1907-39
Year		1930	1908	1930	1930
June	c.f.s.	1,440	157	15.6	151
July	"	251	162	5.24	21
August	"	74.4	103	4.95	2.5
September	"	43.4*	19.8*	4.35	.65*
Year		1932	1910	1932	1932
June	"	665	798	16.9	205
July	"	1,960	342	176	812
August	"	544	25.4	57.8	160
September	"	115	454	3.89*	12.9
Year		1936	1936	1936	1908
June	"	484	30.7	7.48	388
July	"	1,930	254	73.5	391
August	"	784	136	107	83.8
September		221	38.5	26.2	17.2

* Minimum Month.

Table Mo-6 Monongahela River Basin - Monthly Mean Summer Flows for Years in Which Low Summer Flows have Occurred.

River Location		Monongahela Charleroi Pa.	Turtle Cr. Trafford Pa.	Youghiogheny Connellsville Pa.	Cheat R. Parsons W.Va.
River Miles Above:					
Conf. with Mon. R.		-	5.5	44.4	78.4
Mouth of Mon. R.		42	16.5	60	167.5
Drain. Area Sq.Mi.		5,213	54.8	1,326	719
Period of Record		1933-39	1916-39	1909-39	1913-39
Year		1936	1932	1939	1930
June	c.f.s.	1,345	3.59	1,974	573
July	"	1,337	2.37	1,571	89.3
August	"	2,172	.96	285	34.9
September	"	911	.56*	85.2*	23.3*
Year		1934	1930	1910	1932
June	"	1,009	48.9	5,229	496
July	"	4,296	4.37	575	1,560
August	"	1,501	.95	100	376
September	"	475*	1.22	218	87.9
Year		1939 (1)	1922	1914	1936
June	"	7,488	25.3	1,230	305
July	"	7,471	58.8	536	1,340
August	"	2,280	2.49	323	475
September	"				

(1) Regulated by Tygart Reservoir.

River Location		Cheat R. Pisgah, W.Va.	West Fork Enterprise W.Va.	West Fork Clarksburg W.Va.	Tygart R. Belington W.Va.
River Miles Above:					
Conf. with Mon. R.		18	13.0	30.7	61.9
Mouth of Mon. R.		107.1	141.1	158.8	190
Drain. Area Sq.Mi.		1,360	759	384	408
Period of Record		1928-39	1907-16 1933-39	1923-39	1907-39
Year		1930	1908	1930	1930
June	c.f.s.	1,440	157	15.6	151
July	"	251	162	5.24	21
August	"	74.4	103	4.95	2.5
September	"	43.4*	19.8*	4.35	.65*
Year		1932	1910	1932	1932
June	"	665	798	16.9	205
July	"	1,960	342	176	812
August	"	544	25.4	57.8	160
September	"	115	454	3.89*	12.9
Year		1936	1936	1936	1908
June	"	484	30.7	7.48	388
July	"	1,930	254	73.5	391
August	"	784	136	107	83.8
September		221	38.5	26.2	17.2

* Minimum Month.

Fig. Mo-6

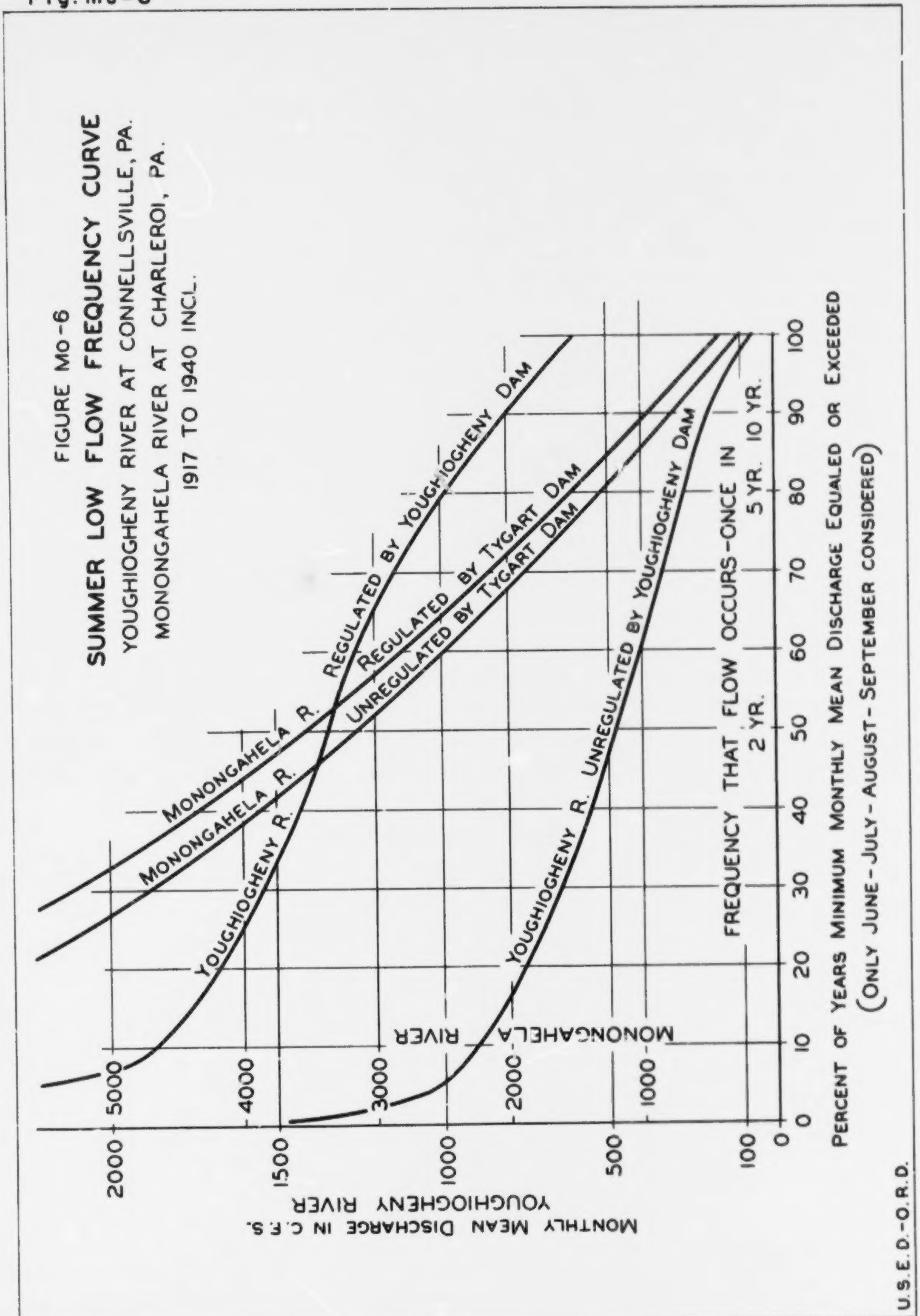

FIGURE Mo-6

SUMMER LOW FLOW FREQUENCY CURVE

YOUGHIOGHENY RIVER AT CONNELLSVILLE, PA.

MONONGAHELA RIVER AT CHARLEROI, PA.

1917 TO 1940 INCL.

U.S.E.D.-O.R.D.

Discussion

The major problem in this basin is the control of acidity from acid mine drainage which enters the streams. The demonstrated success of acid control at the mine by sealing has indicated a promising line of attack on the mine acid problem. In addition, flow regulation is a valuable supplementary control measure. A discussion of this problem, concluding with the presentation of a mine sealing - flow regulation acid control program for the area above the Ohio - West Virginia - Pennsylvania line, will be found in the acid mine drainage section of the Report.

Stream restoration requires control of all types of pollution and up to the present time uncorrected acid mine pollution has served as a deterrent to organic pollution abatement. The germicidal and chemical coagulating action of the acid and iron salts may greatly reduce acute odor and nuisance conditions during normal times and this point has been the subject of considerable discussion. However, sludge deposits, visual nuisance from floating sewage materials, and odors are present at and below sewer outlets. Water supplies from the river below have no dependable safeguard because of fluctuations in acidity and the possible sudden elimination of nearly all acid during high flows. Damages from acid conditions in the upper Ohio Basin are estimated at over $2,000,000 per year, excluding unevaluated and intangible damages believed at least to equal the tangible damages.

In considering stream restoration in mine acid areas, mine acid control and organic pollution abatement should be carried on as parallel programs. Both measures are necessary if complete restoration is to be obtained. A single measure may be amply justified in individual cases but maximum benefits are possible only when the two programs are carried on in parallel. The suggested program of sewage and industrial waste treatment outlined herein will be fully justified only in conjunction with a comprehensive acid reduction program.

Pittsburgh and Vicinity

At present, nearly all of the sanitary sewage and industrial wastes from Pittsburgh and vicinity are discharged directly into the creeks and rivers, causing unsightly and malodorous conditions along all water fronts. This area receives the largest pollution load in the basin, aggregating a total of about 460,000 sewered population equivalent. The Pittsburgh problem is discussed and cost estimates are included under the Main Ohio River. Effective chemical treatment at a site or sites, chiefly on the Ohio River, appears feasible, or primary treatment, plus maintenance of increased summer flow below Pittsburgh, offers a promising alternate solution.

Youghiogheny River

This stream receives a total pollution load of 106,000 sewered population equivalent. Of the 5 treatment plants, the largest is at Somerset, Pennsylvania, and serves 5,400 persons. Laboratory findings show low coliform, biochemical oxygen demand and pH results while the dissolved oxygen results are fairly high. The largest sources of pollution are at Greensburg, Connellsville and Somerset, Pennsylvania.

Primary treatment should be adequate at Greensburg and at other communities on highly acid streams, pending rather complete acid control. With such control, secondary treatment will be required at Greensburg and at smaller communities located on headwater streams, subject to zero or near-zero flow.

Main Monongahela River (Except Pittsburgh)

McKeesport, Clairton, Belle Vernon, Charleroi, Morgantown and Fairmont are the more important cities located on the main stream. None of these places have waste treatment plants. Industrial wastes are of minor importance except at Clairton and vicinity where there is an industrial waste concentration.

Uniontown, located on Redstone Creek, has primary treatment of domestic sewage for 25,000 persons and for equivalent industrial waste of 2,000. This is the largest treatment plant in the basin. The treatment is adequate at the present time but,should acid in Redstone Creek be controlled, supplementary secondary treatment facilities would be required.

Jeannette, Pennsylvania, on Turtle Creek, has secondary treatment which has been unable to handle all industrial wastes. Pretreatment of these wastes with discharge to the municipal treatment plant is required if full corrective benefits are to be obtained.

Although the laboratory findings indicated generally acceptable conditions at the time of sampling, except for acidity on the main Monongahela River, sewage treatment should be installed to improve conditions at the sewer outfalls, eliminate floating materials, prevent sludge deposits and protect the many water plants located short distances downstream. Primary treatment should be adequate. Although there has already been considerable activity toward correcting industrial waste pollution in the Clairton area, certain minor additional steps are indicated and continued effort toward reducing this pollution is justified.

Cheat River

This stream is generally in good sanitary condition and show little acidity. Recreational use of the stream is important. The largest source of pollution is found at Parsons, West Virginia, on the headwaters and is principally due to industrial waste. In view of the present condition of the stream, primary treatment of waste seems justified to remove settleable solids and floating material to prevent local nuisances.

Tygart River

Sanitary conditions are generally good in this stream and acidity is not now a problem, largely because of past mine sealing activities. This stream is used extensively as a source of water supply. Elkins, West Virginia, with a sewered population of 8,100 and industrial waste equivalent of 15,000 additional, is the largest source of pollution on this stream. The domestic sewage is untreated but the industrial waste at Elkins is so treated that a reported reduction of 90 percent in settleable solids is obtained and oxygen conditions are generally improved. A high degree of treatment is justified in this area, not only to improve the stream locally but also to protect the waters of Tygart Reservoir.

West Fork River

Clarksburg, West Virginia, with a sewered population equivalent of 29,000, is by far the largest source of pollution on this stream and its effect is clearly evident in the laboratory findings. The dissolved oxygen is reduced and the biochemical oxygen demand and coliform organisms are increased.

In general, the main stream is not highly acid except near the mouth where many tributary creeks with low pH values discharge acid mine drainage. Two sewage treatment plants are located on this stream.

Secondary treatment of sewage at Clarksburg appears advisable to reduce oxygen demand and coliform counts. At least primary treatment is necessary at all other communities. Weston will require secondary treatment to reduce bacterial pollution.

A summary of costs of the remedial program discussed is shown on Table Mo-1.

TABLE Mo-7 MONONGAHELA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth		Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml.	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
West Fork River Above Weston, W. Va.	MoWf	195	June 14		27.0	7.3	90.2	0.7	15	7.0		36	
" "	"	"	" 26	125	19.5	7.7	83.6	0.6	93	7.0		38	
" "	"	"	July 2	107	18.5	8.1	85.8	0.6	39	7.2			
West Fork River Weston Water Works	MoWf	193.5	June 14		26.0	6.6	80.2	0.3	93	6.9		33	
" "	"	"	" 26	127	19.5	7.0	75.7	0.8	43	6.9		29	
" "	"	"	July 2	109	18.5	7.3	77.6	0.5	93	7.0			
West Fork River Above Polk Creek	MoWf	183.2	June 17	119	23.5	6.7	77.6	1.0	2,400	7.0		47	
" "	"	"	" 26	130	20.5	7.3	80.0	1.4	2,400	6.9		42	
" "	"	"	July 2	110	19.0	7.7	82.4	1.6	430	7.0			
Polk Creek at mouth Weston, W. Va.	MoWfP	193.5	June 14		26.5	3.4	42.4	3.7	930	6.9	60	47	47
" "	"	"	" 26	8	18.5	5.5	58.5	1.8	1,100	7.0	45	52	46
" "	"	"	July 2	19	18.0	7.1	74.5	1.4	2,400	7.0	24		41
Stone Coal Creek at Mouth Weston, W. Va.	MoWfS	194	June 14		27.0	5.4	66.4	0.7	230	6.9	90	44	42
" "	"	"	" 26	44	18.5	7.6	81.0	0.8	240	7.0	48	44	37
" "	"	"	July 2	57	17.5	7.9	81.5	0.9	93	7.1	48		41
West Fork River below Stone Coal Creek below Weston, W. Va.	MoWf	192	June 14		26.5	6.0	74.0	1.8	460	6.8		35	
" "	"	"	" 26	190	17.5	7.1	73.7	1.2	1,100	7.0	97	50	35
" "	"	"	July 2	190	19.0	7.6	81.3	1.1	460	7.1			
West Fork River Below Jackson Mill	MoWf	189	June 14		28.0	5.7	71.7	0.8	43	7.0	190	43	35
" "	"	"	" 26	197	20.0	6.5	71.1	0.9	460	6.9		48	
" "	"	"	July 2	195	20.0	6.8	74.0	1.3	460	7.0	76		43
West Fork River below Hackers Creek, Jane Lew, W. Va.	MoWf	180.3	June 17	220	22.5	6.2	71.3	0.9	23	7.0		41	
" "	"	"	" 27	210	20.5	7.0	77.6	0.5	23	7.1		41	
" "	"	"	July 3	359	19.5	7.5	81.3	1.5	240	7.2			
West Fork River West Milford, W. Va.	MoWf	174	June 17	244	22.5	7.0	79.4	0.9	43	7.0		21	
" "	"	"	" 27	224	21.0	7.6	84.2	0.8	43	7.1		39	
" "	"	"	July 3	415	20.0	7.8	85.2	1.0	43	7.2			
West Fork River Nutter Fort, W. Va.	MoWf	167	June 17	268	23.5	7.1	82.2	1.0	43	7.1	47	39	45
" "	"	"	" 27	238	20.5	7.4	81.6	0.4	9	7.1	76	54	44
" "	"	"	July 3	472	20.5	7.9	87.2	0.8	93	7.2	72		40
Brown Creek at mouth Two Lick, W. Va.	MoWfB	166	June 17	10	20.5	7.7	84.9	2.5 1.2*	1	3.0	205		520
" "	"	"	" 27	3	17.5	8.2	84.6	1.6 0.0*	**	2.8	135		660
" "	"	"	July 3	7	20.5	8.1	88.9	3.5 1.0*	2	3.2	110		
West Fork River above Clarksburg, W. Va.	MoWf	161	May 20	695	20.0	7.2	78.5	0.2 0.2*	1	6.0		28	
" "	"	"	" 27	935	18.0	8.0	83.9	3.2	2	6.7	14		
" "	"	"	" 30	235	18.0	8.2	86.0	0.8	2	6.0	16		

TABLE No-7 MONONGAHELA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth		Date 1940	Average Discharge c. f. s.	Temp. °C	Dissolved Oxygen		5 Day B. O. D. p. p. m.	Coliforms M. P. N. Per ml.	pH	Turbidity p. p. m.	Alkalinity p. p. m.	Hardness p. p. m.
						p. p. m.	% Sat.						
West Fork River above Clarksburg, W. Va.	MoWf	161	June 14	595	23.0	6.1	70.3	1.0	9	6.6		20	
" "	"	"	" 20	1,750	21.0	7.0	77.9	1.6	43	6.7		22	
" "	"	"	" 28	224	22.0	6.4	72.5		9	6.8		18	
" "	"	"	July 2	575	22.0	7.4	83.8	3.2	24	6.5		28	
" "	"	"	" 10	43	22.5	6.8	77.7	0.4	23	6.6		* 24	
West Fork River above mouth Elk Creek above Clarksburg, W. Va.	MoWf	160	July 10		23.5	7.4	85.5	0.9	460	6.8		25	
Elk Creek above Nutter Fort, W. Va.	MoWfE	167	May 20	155	18.0	7.2	75.5	0.2	24	6.6		42	
" "	"	"	" 27	215		8.6		0.4	21	7.1		10	
" "	"	"	" 30	50	17.0	6.7	68.8	1.1	9	6 7		38	
" "	"	"	June 14	135	21.0	7.0	77.9	0.7	9	6.8		28	
" "	"	"	" 20	349	21.0	7.3	81.2	0.5	15	6.9		30	
" "	"	"	" 28	53	22.0	6.9	78.1		2	7.0		35	
" "	"	"	July 2	268	20.0	7.8		1.0		6.4		28	
" "	"	"	" 10	15	22.5	7.0	80.0	0.3	23	7.3		49	
Anmore Creek below Anmore, W. Va.	MoWfA	165	May 28	9	21.0	9.4	104.6	4.0 7.6*	240	3.2			
" "	"	"	June 6	8	24.0	9.0	105.5	3.6 2.2*	**	2.9			
" "	"	"	" 13	55	23.0	7.4	85.3	1.4 0.8*	93	4.5			
" "	"	"	" 19	16	21.0	5.6	62.3	0.6 1.6*	460	5.7		8	
" "	"	"	" 27	2	21.0	8.4	93.4	1.2 1.6*	1	3.1			
" "	"	"	July 1	12	20.0	8.2	89.4	1.4		6.3		20	
Elk Creek W. Pike St. Bridge Clarksburg, W. Va.	MoWfE	159	July 10		23.0	5.6	63.9	6.0 9.6*	730	4.6		7	
Elk Creek at mouth Clarksburg, W. Va.	MoWfE	158	May 20	174	20.0	5.2	56.7	1.2 2.3*	1,100	6.2		20	
" "	"	"	" 27	235	19.0	8.0	85.6	0.6	150	6.5		16	
" "	"	"	" 30	60	18.0	8.4	88.1	3.2	93	6.0		26	
" "	"	"	June 14	150	23.0	6.9	79.5	1.3	150	6.8		20	
" "	"	"	" 20	370	21.0	6.9	76.8	2.5 2.4*	**	6.7		22	
" "	"	"	" 28	73	21.0	3.3	36.7		2[illegible]0	5.8		18	
" "	"	"	July 2	283		7.4		3.7 5.0*	230	6.6		24	
" "	"	"	" 10	24	24.0	1.4	16.4	2.3 2.8*	360	5.2	10	12	
Limestone Run at mouth Clarksburg, W. Va.	MoWfL	157	May 28	13	21.0	9.0	100.1	2.4 4.6*	2	4.4			
" "	"	"	June 6	11	23.0	8.6	99.1	3.8 4.0*	9	4.8			
" "	"	"	" 13	90	24.0	7.8	91.4	2.0 1.8*	15	4.7		9	
" "	"	"	" 19	21	21.0	8.0	89.0	2.2 2.4*	240	6.1		18	
" "	"	"	" 27	5	21.0	8.0	89.0	2.0 2.4*	2	4.6			
" "	"	"	July 1	18	21.0	8.0	89.0	0.6 1.6*	21	5.6		16	
West Fork River Adamston Bridge Clarksburg, W. Va.	MoWf	156	May 20	895	20.0	5.8	63.2	4.7 4.8*	4	6.1		34	
" "	"	"	" 27	1,200	19.0	8.2	87.7	1.2	21	6.7		12	
" "	"	"	" 30	315	17.0	7.8	80.1	2.4 0.4*	240	6.1		16	
" "	"	"	June 14	765	24.0	7.4	86.8	5.1	93	6.7		18	
" "	"	"	" 20	2,100	23.0	7.0	80.6	3.6 3.2*	150	6.6		18	
" "	"	"	" 28	306	22.0	6.4	72.5		2,400	6.7		20	

TABLE Mo-7 MONONGAHELA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c. f. s.	Temp. °C	Dissolved Oxygen p. p. m.	Dissolved Oxygen % Sat.	5 Day B. O. D. p. p. m.	Coliforms M. P. N. Per ml	pH	Turbidity p. p. m.	Alkalinity p. p. m.	Hardness p. p. m.
West Fork River Adamston Bridge Clarksburg, W. Va.	MoWf 158	July 2	858	22.0	7.4	83.8	4.9 7.3*	240	6.0		24	
" "	" "	" 10		24.0	6.2	72.5	2.4	2,300	6.6		19	
West Fork River Perry Mine below Clarksburg, W. Va.	MoWf 155	May 20	895	20.0	5.8	63.2	0.8 1.0*	240	6.3		26	
" "	" "	" 27	1,200	19.0	8.0	85.6	4.0	9	6.4		16	
" "	" "	" 30	315	17.0	8.0	82.1	2.0 0.9*	460	6.2		18	
" "	" "	June 14	765	24.0	6.4	75.0	6.2	240	6.8		19	
" "	" "	" 20	2,100	22.0	7.0	79.3	1.2	150	6.7		18	
" "	" "	" 28	306	22.0	6.3	71.3		750	6.3		14	
" "	" "	July 2	858	22.0	7.4	83.8	2.1	240	6.1		24	
" "	" "	" 10		24.0	3.8	44.3	2.6	2,300	6.3		18	
West Fork River Above Zeising, W. Va.	MoWf 149.8	May 20	900	21.0	6.2	69.0	2.6 2.0*	**	5.4		6	
" "	" "	" 27	1,210	19.0	8.0	85.6	0.8	21	6.2		16	
" "	" "	" 30	330	18.0	7.4	77.6	2.0	**	5.5		14	
" "	" "	June 14	780	23.0	6.6	76.0	3.0	7	6.4		11	
" "	" "	" 20	2,100	22.0	6.8	77.0	0.8	30	6.6		18	
" "	" "	" 28	306	22.0	6.1	69.1		24	6.3		6	
" "	" "	July 2	858	21.0	7.4		2.3	240	6.3		20	
" "	" "	" 10	80	25.5	5.8	69.3	1.0 1.1*	4	4.1	14		
Simpson Creek above Bridgeport, W. Va.	MoWfS 162	May 28	78	17.0	9.2	94.5	4.2 5.0*	**	2.9			
Simpson Creek above Bridgeport, W. Va.	MoWfS 162	June 6	65	22.0	9.0	101.9	1.4 1.8*		2.8			
" "	" "	" 13	425	20.0	8.5	92.7	3.1 3.1*	1	3.2			
" "	" "	" 19	125	20.0	7.7	84.0	1.3 1.2*	21	3.2			
" "	" "	" 27	22	18.0	7.8	81.8	0.0 0.8*	**	2.8			
" "	" "	July 1	384	17.0	7.4	76.0	0.2 1.8*	110	3.4			
Simpson Cr. Bridge bel. Bridgeport, W. Va.	MoWfS 156	May 28	83	18.0	9.4	98.5	2.4 3.8*	**	3.1			
" "	" "	June 6	68	22.0	9.0	101.9	2.0 2.0*		2.9			
" "	" "	" 13	450	21.0	7.0	77.9	0.2 0.0*	2	3.4			
" "	" "	" 19	125	21.0	7.6	84.5	0.6 1.3*	24	3.5			
" "	" "	" 27	22	19.0	8.4	89.8	0.2 0.8*	1	2.9			
" "	" "	July 1	384	17.0	7.2	73.9	0.0 0.2*	110	3.4			
Salem Fork East Salem, W. Va.	MoWfTSa168.5	May 28	11	20.0	2.6	28.4	9.6	210	7.1		130	
" "	"	June 6	9	24.0	3.0	35.2	10.4	430	6.8			
Salem Fork East Salem, W. Va.	MoWfTSa168.5	June 13	70	25.0			7.6 8.8*	150	6.8		52	
" "	" "	" 19	18	21.0	5.8	64.5	3.5 3.6*		6.9		32	
" "	" "	" 27		21.0			4.4 3.2*	93	7.0		72	
" "	" "	July 1	10	19.0	6.4	68.4	4.8	930	6.4		24	

TABLE No-7 MONONGAHELA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Salem Fork below East Salem, W. Va.	MoWfTSa 167.5	May 28	12	17.0	7.8	80.1	3.8 1.2*	210	7.0		124	
" "	" "	June 6	10	24.0	4.8	56.3	2.2 2.4*	29	6.6		42	
" "	" "	" 13	74	25.0	2.0	23.9	4.8 4.8*	24	6.9		62	
" "	" "	" 19	18	21.0	6.0	66.7	3.6 3.2*	240	6.7		26	
" "	" "	" 27		21.0	4.2	46.7	1.2 2.4*	360	7.0		62	
" "	" "	July 1	10	19.0	6.6	70.6	2.6	1,100	6.4		28	
Ten Mile Creek Above Lumberport Laura Lee, W. Va.	MoWfT 148	May 29	560	18.0	8.6	90.1	0.2	4	5.8		9	
" "	" "	June 7	43	19.0	7.2	77.0	0.2 0.4*	1	6.0		8	
" "	" "	" 18	581	23.0	7.0	80.6		9	6.1		12	
Ten Mile Creek Above Lumberport Above Laura Lee, W. Va.	MoWfT 148	June 21	92	19.0	7.8	83.4	1.2	24	6.6		21	
" "	" "	" 29	61	22.0	7.2	81.5	1.2	460	6.2		16	
" "	" "	July 3	116	17.0	8.2	84.2	0.8	93	6.1		30	
Ten Mile Creek At mouth below Lumberport, W. Va.	MoWfT 146.5	May 29	570	18.0	9.2	96.4	1.0 2.0*	**	4.6		9	
" "	" "	June 7	47	24.0	7.0	82.1	2.6 2.8*	**	4.8			
" "	" "	" 18	581	22.0	6.2	70.2	4.0 4.2*	3	6.3		5	
" "	" "	" 21	92	19.0	7.8	83.4	1.3 0.9*	24	6.5		18	
" "	" "	" 29	61	21.0	7.1	79.0	0.9	93	6.1		14	
" "	" "	July 3	117	22.0	7.8	88.3	0.1	24	5.6		20	
West Fork River Bridge Bel. Ten Mile Creek Bel. Lumberport, W. Va.	MoWf 145.5	June 7		23.0	5.4	62.2	0.2 0.2*	**	3.2			
" "	" "	" 18	610	23.0	6.9	79.5	0.9 1.9*	150	3.4			
" "	" "	" 21	1,430	20.0	7.1	77.4	1.5 1.2*	43	4.7			
" "	" "	" 29	525	22.0	7.4	83.8	0.4 0.2*	24	3.3			
" "	" "	July 3	4,370	18.0	7.2	75.5	0.6 1.8*	240	4.4			
West Fork River below Shinnston, W. Va.	MoWf 143.5	May 29	700	19.0	8.8	94.1		9	3.5			
" "	" "	June 7	370	25.0	6.2	74.0	0.6 0.2*	**	3.2			
" "	" "	" 18	710	23.0	6.4	73.7	0.9 1.[illegible]*	93	3.4			
" "	" "	June 21	1,320	20.0	7.4	80.7	0.9 0.8*	43	4.8			
" "	" "	" 29	525	22.0	7.2	81.5	0.0 1.2*	43	3.4			
" "	" "	July 3	4,370	19.0	7.4	79.1	1.6 3.3*		4.6			
West Fork River Bridge abv. Worthington, W.Va.	MoWf 138	May 21	4,950	19.0	7.6	81.3	1.2 1.0*	6	5.7			
" "	" "	June 12	780	27.0	7.6	94.2	1.4 1.4*	9	3.5			
" "	" "	" 26	755		7.6		1.2 0.6*	93	3.8			
West Fork R.Highway Br. bel. Monongah, W. Va.	MoWf 132.5	May 21	5,130	19.0	7.4	79.1	2.0 1.8*	43	6.0		12	
" "	" "	" 24	600	20.0	7.2	78.5	0.8 1.0*	24	3.6		14	
" "	" "	June 4	1,250	19.0	7.6	81.3		2	3.3			
" "	" "	" 12	800	27.0	6.6	81.8	0.2 0.2*	24	3.5			
" "	" "	" 26	759		7.3		0.1 0.1*	24	3.8			
West Fork River at mouth Fairmont, W. Va.	MoWf 129	May 21	5,250	19.0	7.2	77.0	0.4 0.8*	5	5.4		10	
" "	" "	" 24	640	21.0	5.2	57.8	0.4 0.5	2	4.4		2	

TABLE Mo-7 MONONGAHELA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c. f. s.	Temp. °C.	Dissolved Oxygen		5 Day B. O. D. p. p. m.	Coliforms M. P. N. Per ml.	pH	Turbidity p. p. m.	Alkalinity p. p. m.	Hardness p. p. m.
					p. p. m.	% Sat.						
West Fork River at mouth Fairmont, W. Va.	MoWf 129	June 4	1,300	19.0	8.0	85.6		2	4.3			
" "	" "	" 12	850	28.0	5.8	73.2	0.0 1.4*	2	3.6			
" "	" "	" 26	788		6.9		0.3 0.0*	23	3.9			
Tygart River Water Plant Intake Above Elkins, W. Va.	MoTy 211	June 13		18.5	7.9	83.7	0.9	1,100	6.9		30	
" "	" "	" 21	770	16.5	8.4	85.1	0.8	23	7.0		39	
" "	" "	July 1	388	19.0	8.1	86.5	0.7	43	7.2			
" "	" "	" 9	196	21.0	8.4	93.0	0.9	750	7.3			
Tygart River 4 miles below Elkins, W. Va.	MoTy 205.5	June 13		22.0	7.2	81.9	2.0	2,400	6.8		28	
" "	" "	" 21	790	16.0	8.2	82.4	1.0	210	6.9		31	
" "	" "	July 1	410	17.5	7.5	78.2	1.7	460	6.9			
" "	" "	" 9	215	20.0	6.2	67.5	1.6	230	6.9			
Grassy Run at mouth Norton, W. Va.	MoTyG 202	July 9	1	16.0	8.2	82.6	2.0*	**	2.5	5		
Tygart River 7 miles below Elkins, W. Va.	MoTy 201.5	July 9	226	20.0	7.0	76.8	1.6	150	7.1			
Tygart R. 8 mi. below Elkins Norton, W. Va.	MoTy 201.3	June 13		22.0	7.5	85.3	0.7	2,400	6.9		27	
" "	" "	" 21	950	16.0	8.5	85.3	0.9	930	7.0		30	
" "	" "	July 1	490	18.0	7.8	81.8	0.6	110	7.1			
" "	" "	" 9	238	21.5	7.2	80.8	0.7		7.2	13		43
Tygart River Bridge lower edge of Belington, W. Va.	MoTy 192	June 13		23.5	8.0	93.6	0.9	1,100	6.9	200	32	30
" "	" "	" 21	1,100	14.5	9.0	87.5	0.5	240	6.8	18	25	30
" "	" "	July 1	592	17.0	8.4	86.3	0.7	230	6.8	22		39
Middle Fork River Burnt Bridge, W. Va.	MoTyMf 198	June 13		23.5	8.2	95.7	0.2	3	6.8	7	18	15
" "	" "	" 21	250	13.5	9.5	90.3	0.4	46	6.7	8	13	12
" "	" "	July 1	210	16.5	8.8	88.9	0.4	7	6.7	6		12
Buckhannon River Above Buckhannon, W. Va.	MoTyBu 206	June 13		24.0	7.4	87.0	0.2	46	6.7		17	
" "	" "	" 21	350	15.5	8.8	87.6	0.7	43	6.7		19	
" "	" "	July 1	240	17.0	8.5	87.1	0.4	93	6.7			
Buckhannon River below Buckhannon, W. Va.	MoTyBu 201.5	June 13		25.5	7.0	84.0	0.4	150	6.7	35	24	20
" "	" "	" 21	550	16.0	8.4	84.5	0.5	43	6.7	13	23	24
" "	" "	July 1	460	18.0	8.0	84.2	1.0	93	6.7	28		20
Buckhannon River Carrollton, W. Va.	MoTyBu 180	June 12		25.5	7.2	87.0	1.7	210	6.6	500	23	22
" "	" "	" 20	1,450	19.0	8.3	89.2	1.3	240	6.6	24	21	19
" "	" "	" 28	366	21.0	8.3	92.2	1.0	9	6.8	23		21
Tygart River above Philippi, W. Va.	MoTy 174.5	June 12		27.0	7.7	95.5	1.7	150	6.8		42	
" "	" "	" 20	4,500	18.0	8.8	91.7	0.9	460	6.7		23	
" "	" "	" 28	980	20.5	8.2	90.0	0.6	4	6.6			

TABLE Mo-7 MONONGAHELA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth		Date 1940		Average Discharge c. f. s.	Temp. °C	Dissolved Oxygen		5 Day B. O. D. p. p. m.	Coliforms M. P. N. Per ml	pH	Turbidity p. p. m.	Alkalinity p. p. m.	Hardness p. p. m.
							p. p. m.	% Sat.						
Tygart River Arden, W. Va.	MoTy	166.5	June	12		27.0	7.6	94.5	0.5	23	6.9		28	
" "	"	"	"	20	8,000	17.5	8.7	89.8	1.4	93	6.8		27	
" "	"	"	"	28	1,000	21.5	8.2	92.0	0.4	4	6.8			
Tygart River Steel Bridge above Grafton, W. Va.	MoTy	150	June	12		21.5	10.2	114.1	0.3	2	6.6		18	
" "	"	"	"	20	8,400	17.0	10.3	105.7	0.7	4	6.6		18	
" "	"	"	"	28	1,550	20.0	9.5	103.7	0.4	23	6.8			
Three Forks Creek ½ mile above mouth Grafton, W. Va.	MoTyTf	149.5	June	12		26.0	8.1	98.4	0.5 0.7*	43	5.6	2	16	52
" "	"	"	"	20	432	16.0	9.3	93.7	0.5	240	6.6	23	20	35
" "	"	"	"	28	70	21.5	8.2	92.6	1.8 1.5*	43	5.8	8		57
Tygart River Bridge on Rt. 50 Below Grafton, W. Va.	MoTy	146.7	June	12		21.0	9.5	105.6	0.4	23	6.7		15	
" "	"	"	"	20	8,800	17.0	10.1	103.3	0.7	43	6.6		16	
" "	"	"	"	28	1,620	20.5	9.3	102.4	0.6	23	6.8			
Tygart River 3 miles above mouth Benton Ferry, W. Va.	MoTy	132	June	12		22.5	8.9	101.3	0.4	23	6.6	14	17	30
" "	"	"	"	20	8,800	16.5	9.7	98.6	0.6	23	6.6	27	19	26
" "	"	"	"	28	1,630	20.5	8.4	92.8	0.6	23	6.8	20		27
Monongahela R. Highway Bridge Fairmont, W.Va.	Mo	126.7	May	21	6,520	18.0	7.6	79.7	0.0 0.2*	**	5.0		10	
" "	"	"	"	24	2,420	18.0	8.8	92.2	2.6 2.4	3	4.4		4	
" "	"	"	June	4	7,540	19.0	8.2	87.7		93	5.4		12	
" "	"	"	"	12	2,400	27.0	6.4	79.3		1	3.9			
" "	"	"	"	26	2,420		7.4		1.4 0.8*	21	4.5		4	
Buffalo Creek Bridge above Mannington, W. Va.	MoBc	145	May	29	30	19.0	6.8	72.7		150	6.6		32	
" "	"	"	June	7	22	25.0	7.2	85.9	0.4 0.8*	24	7.0		20	
" "	"	"	"	18	32	22.0	6.6	74.7	0.9	93	6.3		28	
" "	"	"	"	21	21	18.0	7.8	81.8	0.8	15	6.9		24	
" "	"	"	"	29	32	23.0	6.3	72.6	1.3	93	6.9		26	
" "	"	"	July	3	33	19.0	8.0	85.6	2.4	43	5.9		26	
Buffalo Cr. Foot Br. bel. Mannington, W. Va.	MoBc	140.7	May	29	115	20.0	7.4	80.7		200	6.4		32	
" "	"	"	June	7	45	25.0	5.2	62.1	2.6 2.8*	**	7.0		26	
" "	"	"	"	18	118	23.0	6.3	72.6	1.9 2.0*	930	6.3		28	
" "	"	"	"	21	75	18.0	7.8	81.8	0.8 0.8*	210	6.9		26	
" "	"	"	"	29	62	22.0	6.0	68.0	3.2 1.0*	750	6.8		28	
" "	"	"	July	3	94	18.0	8.0	83.9	1.0	240	5.8		26	
Buffalo Cr. R.R. Br. at mouth Fairmont, W. Va.	MoBc	127	May	21	575	18.0	7.8	81.8	1.6 1.3*	1	5.4		12	
" "	"	"	"	24	70	21.0	7.2	80.1	2.2 2.4*	110	6.2		12	
" "	"	"	June	4	150	20.0	8.0	87.2		43	5.2		10	
" "	"	"	"	12	98	26.0	7.2	87.6	2.8 4.0*	4	7.0		48	
" "	"	"	"	26	76		7.6		2.8 0.8*	75	6.9		64	
Monongahela R. R.R. Br. bel. Fairmont, W. Va.	Mo	124.2	May	21	7,100	19.0	8.2	87.7	1.0 1.2*	**			10	
" "	"	"	"	24	2,500	18.0	8.6	90.1	1.6 1.6*	2	6.6		8	

TABLE No-7 MONONGAHELA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Monongahela R. R.R. Br. bel. Fairmont, W. Va.	Mo 124.2	June 4	7,700	19.0	8.4	89.8		9	5.2		12	
" "	" "	" 12	2,500	27.0	6.6	81.8	0.2 0.4*	1	3.9			
" "	" "	" 26	2,500		7.4		0.6 0.2*	93	4.5		4	
Monongahela River Lock # 11 above Morgantown, W. Va.	Mo 104.1	May 16	1,030	16.0	8.8	88.4		••	3.5		50	
" "	" "	" 23	3,200	20.0	8.6	93.8	1.4 1.8*	••	4.5		8	
" "	" "	June 3	11,300	19.0	8.2	87.7	0.4 0.6*	••	5.2		4	
" "	" "	" 11	3,000	26.0	7.8	94.9	0.4 0.6*	1	4.0			
" "	" "	" 17	3,000	23.0	8.0	92.2	2.0 0.9*	2	4.9			
" "	" "	" 25	9,350		8.1		0.5 0.9*	4	5.1		6	
Deckers Cr. Br. above Sabraton, W. Va.	MoDe 104	June 3	50	15.0	9.6	94.6	1.4 1.8*	••	5.4		4	
" "	" "	" 11	15	25.0	7.6	90.7	1.6 2.0*	2	4.5			
" "	" "	" 17	45	23.0	7.6	87.6	1.4 0.6*	2	3.9			
" "	" "	" 25	49		7.9		0.2 0.1*	1	4.6			
Deckers Creek Shirt Factory Bridge Above Morgantown, W. Va.	MoDe 103	May 16	10	16.0	8.8	88.4		43	4.1		6	
" "	" "	" 23	20	19.0	9.0	96.3	2.0	1	5.1		6	
" "	" "	June 3	55	15.0	9.4	92.6	0.6 1.2*	1	5.2		4	
" "	" "	" 11	20	25.0	7.4	88.3	1.6 2.0*	15	4.5			
" "	" "	" 17	30	23.0	7.8	89.9	2.0 0.9*	24	3.9			
" "	" "	" 25	54		8.0		0.6 1.7*	9	4.6		2	
Deckers Creek R.R. Bridge at mouth Morgantown, W. Va.	MoDe 101	May 16	15	16.0	8.0	80.4		110	4.5			
" "	" "	" 23	25	20.0	8.0	87.2	1.4 2.0*	150	4.9		6	
" "	" "	June 3	60	16.0	9.4	94.5	3.4 3.0*	7	5.2		6	
" "	" "	" 11	25	25.0	7.4	88.3	4.0 3.8*	24	4.6			
" "	" "	" 17	35	23.0	6.8	78.3	6.0 2.6*	15	4.5			
" "	" "	" 25	54		7.8		2.6 4.0*	930	5.3		5	
Monongahela River River Bridge Morgantown, W. Va.	Mo 100.9	May 16	1,050	16.0	8.0	80.4		••	3.5		34	
" "	" "	" 23	3,250	20.0	8.8	96.0	1.4 2.0*	1	4.4		6	
" "	" "	June 3	11,400	19.0	8.2	87.7	2.0 1.8*	4	5.0		6	
" "	" "	" 11	3,050	25.5	7.8	94.0	1.0 1.6*	4	4.4			
" "	" "	" 17	3,000	23.0	7.4	85.3	0.6 0.6*	4	4.8			
" "	" "	" 25	9,400		8.0		1.2 0.8*	9	5.4		6	
Monongahela River River Ferry Star City, W. Va.	Mo 97.7	May 16	1,070	17.0	8.8	90.3		••	3.5		36	
" "	" "	" 23	3,300	20.0	8.2	89.4	1.4 1.0*	1	5.2		4	
" "	" "	June 3	11,400	19.0	8.8	94.1	0.2 0.0*	2	4.3			
" "	" "	" 11	3,050	26.0	7.8	94.9	0.2 0.2*	2	4.2			
" "	" "	" 17	3,000	23.0	7.8	89.9	0.1 0.0*	2	4.4			
" "	" "	" 25	9,450		7.6		0.3 0.5*	93	4.6		2	
Monongahela River Dam No.8 Pt. Marion, Pa.	Mo 90	May 31	38,000	16.0	9.6	96.5	0.8	8	5.0		8	
" "	" "	June 10	3,250	21.0	7.6	84.5	0.8 1.0*	8	3.9		15	
" "	" "	" 22	6.790	19.0	8.2	87.7	0.0 0.4*	24	5.1		4	

TABLE No-7 MONONGAHELA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Monongahela River Dam No. 8 Pt. Marion, Pa.	Mo 90	Aug. 19	450	26.5	7.3	90.0	0.5* 0.5	**	3.3			
" "	" "	" 27	450	23.5	8.2	94.9	0.7 0.4*	**	3.2			
" "	" "	Sept. 4	1,010	23.5	7.8	91.3	1.1 0.6*	**	3.5			
" "	" "	" 13	845	21.0	8.4	93.1	1.[illegible] 0.[illegible]*	**	3.2			
" "	" "	" 17	845	20.5	8.4	92.6	1.1 0.[illegible]*	**	3.4			
" "	" "	" 24	340	21.5	7.8	87.0	1.1 0.9*	**	3.5			
" "	" "	Oct. 2	1,770	17.0	9.2	94.5	0.6 0.6*	4	4.3			
" "	" "	" 8	1,370	17.5	9.1	94.1	0.8 0.7*	1	3.8			
" "	" "	" 17	630	16.0	9.2	92.3	1.0 0.8*	**	3.5			
" "	" "	" 22	630	13.0	9.7	91.5	1.2 0.9*	**	3.5			
" "	" "	" 30	1,050	13.5	10.0	95.1	2.4 1.8*	**	3.7			
" "	" "	Nov. 4	4,140	12.5	11.1	103.3	1.1 1.1*		4.6			
" "	" "	" 12	1,830	11.5	10.8	98.8	0.9 0.4*	**	4.1			
" "	" "	" 20	2,110	7.5	11.5	95.9	1.2 1.7*	**	4.3			
" "	" "	" 26	4,190	7.5	12.2	101.9	0.6 0.9*	2	4.2		-	
" "	" "	Dec. 5	4,000	4.0	13.1	99.9	0.6 0.4*	1	4.1			
" "	" "	" 9	4,500	4.0	12.7	96.4	0.8 0.5*	**	4.1			
Shaver Fork 3½ miles above Parsons Porterwood, W. Va.	MoChS 166	June 19	2,800	15.5	8.6	86.0	1.2	9	6.6	27	22	23
" "	" "	" 25	430	18.5	8.5	89.9	0.3	15	6.9	4	31	25
" "	" "	July 5	380	16.5	8.9	90.4	0.5	4	6.8	3		24
Blackwater River Above Falls in State Park-Davis, W. Va.	MoChDfBl-180	June 19	600	18.0	7.8	81.2	1.6	150	6.5		22	
" "	" "	" 25	135	16.5	8.4	85.8	0.9	120	6.9		30	
" "	" "	July 5	325	15.0	8.6	84.8	1.9	43	6.7			
N.Fk.Blackwater River Bridge Above Thomas, W. Va.	MoChNBl 182	June 19	64	17.0	6.7	68.6	0.7 0.9*	43	5.6		17	
" "	" "	" 25	29	16.5	7.6	77.0	0.2 0.4*	4	5.5		20	
" "	" "	July 5	37	14.5	7.5	72.9	0.5 0.4*	23	5.5			
N.Fk.Blackwater R. Below Thomas, W. Va.	MoChNbL-1805	June 19	64	17.5	8.1	84.0	1.3	93	6.3	23	25	44
" "	" "	" 25	29	18.0	8.0	83.9	0.5 0.7*	9	4.7	20	26	80
" "	" "	July 5	38	15.5	8.5	84.6	0.5 0.6*	4	5.3	25		
Blackwater R. Bridge at south Hendrick, W. Va.	MoChDfBl-172	July 19	1,000	18.5	8.3	88.2	1.2 1.2*	46	5.3	35	18	26
" "	" "	" 25	250	16.5	8.7	88.6	0.5 0.6*	43	[illegible].4	34	21	39
" "	" "	July 5	520	14.0	9.2	88.4	0.8 0.7*	9	4.6	28	—	
Dry Fork River Hendrick, W. Va.	MoChDf 172	June 19	1,800	16.5	9.0	91.0	0.7	23	7.[illegible]		37	
" "	" "	" 25	530	17.5	8.8	91.7	0.4	23	7.3		33	
" "	" "	July 5	530	15.0	9.3	91.6	0.4	9	6.9			
Dry Fork River Bridge Above Parsons, W. Va.	MoChDf 168	June 19	2,800	18.5	8.7	91.9	1.1	23	6.9	25	28	34
" "	" "	" 25	780	16.5	7.6	87.1	0.4	23	6.6	22	30	3[illegible]
" "	" "	July 5	1,100	14.5	9.1	89.0	0.5	9	6.6	15		30

TA LE Mo-7 MONONGAHELA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Milage From Mouth	Date 1940	Average Discharge c. f. s.	Temp. °C	Dissolved Oxygen p. p. m.	Dissolved Oxygen % Sat.	5 Day B. O. D. p. p. m.	Coliforms M. P. N. Per ml	pH	Turbidity p. p. m.	Alkalinity p. p. m.	Hardness p. p. m.
Cheat River 2 miles below Parsons Holly Meadows, W. Va.	MoCh 165.5	June 19	5,600	17.5	8.7	89.9	0.8	23	6.9	28	28	29
" "	" "	" 25	1,380	17.5	8.4	86.7	0.3	15	6.8	16	33	27
" "	" "	July 5	1,700	15.0	8.9	88.6	0.3	23	6.7	14		26
Cheat River 5 miles below Parsons St. George, W. Va.	MoCh 158	June 18	4,000	20.5	8.1	88.9	0.5	39	6.9	22	26	45
" "	" "	" 24	1,500	21.0	8.1	89.7	0.6	9	6.9	17	23	33
" "	" "	July 8	990	18.0	8.6	90.1	0.4	46	6.9	13		30
Cheat River Foot Bridge below Rowlesburg, W. Va.	MoCh 133	June 18	4,300	22.0	8.1	91.4	0.7	120	6.9		24	
" "	" "	" 24	1,550	23.0	8.2	94.9	0.3	23	6.9		28	
" "	" "	July 8	1,250	21.0	8.7	96.9	0.8	23	6.8			
Cheat River - 1 mile East of Kingswood Caddell, W. Va.	MoCh 120.5	June 18	4,600	21.0	8.3	92.7	0.6	23	6.8		22	
" "	" "	" 24	1,600	20.5	8.3	91.6	0.3	9	6.9		29	
" "	" "	July 8	1,120	20.0	8.7	94.9	0.3	4	6.8			
Green Run Creek Between Kingwood and Albright, W. Va.	MoChGr 118.5	June 18	12	20.0	8.4	91.6	0.8 0.4*	110	3.6	30		44
" "	" "	" 24	8	19.5	8.3	90.1	0.4 0.1*	4	3.5	13		47
" "	" "	July 8	5	17.5	9.0	93.6	0.7 0.3*	**	3.3	18		
Cheat Lake Bridge at Ices Ferry	MoCh 100.5	May 31	32,000	13.0	10.2	96.2	1.6	15	6.5		8	
" "	" "	June 10	2,400	21.0	7.4	82.3	1.6 2.0*	75	6.1		10	
" "	" "	" 22	1,220	20.0	7.4	80.7	0.4	21	6.5		8	
Cheat River Bridge at mouth Point Marion, Pa.	MoCh 90	May 31	35,300	16.0	9.8	98.5	0.8	1	6.4		10	
" "	" "	June 10	3,730	21.0	8.6	95.7	1.0 1.0*	9	3.9			
" "	" "	" 22	1,220	21.0	7.4	82.3	0.6	24	6.1		8	
Monongahela River Lock & Dam #7 Greensboro, Pa.	Mo 84.6	May 31	61,900	15.0	9.2	90.6	0.8	9	5.7		8	
" "	" "	June 10	4,060	21.0	7.4	82.3	1.4 1.4*	24	3.9			
" "	" "	" 22	9,230	18.0	8.4	88.1	0.5 0.6*	24	5.3		7	
" "	" "	Aug. 19	640	26.0	7.5	91.5	0.6* 0.7	**	3.4			
" "	" "	" 27	1,020	22.0	8.6	97.1	0.6* 1.2	**	3.2			
" "	" "	Sept. 4	1,480	22.5	8.3	94.7	0.6 0.9*	**	3.8			
" "	" "	" 13	1,020	20.5	8.0	87.6	1.0 0.8*	**	3.6			
" "	" "	" 17	1,020	20.5	8.3	91.4	1.5 1.0*	**	3.3			
" "	" "	" 24	830	21.5	8.2	92.1	0.5* 1.0	**	3.5			
" "	" "	Oct. 2	1,940	16.5	9.7	98.2	0.5 0.6*	2	4.3			
" "	" "	" 8	1,480	17.0	9.1	93.8	0.7 0.7*	2	3.8			
" "	" "	" 17	1,240	15.5	9.3	92.7	1.0 0.8*	**	3.7			
" "	" "	" 22	1,240	13.0	10.1	95.0	1.4 0.9*	**	3.7			
" "	" "	" 30	1,480	13.0	10.3	96.9	2.6 1.4*	**	3.7			
" "	" "	Nov. 4	5.740	12.0	10.8	99.7	1.4 1.6*	4	4.7			
" "	" "	" 12	2,020	11.0	11.2	101.1	0.8	**	6.5		3	
" "	" "	" 20	2,630	7.5	12.0	99.8	0.7	**	6.1		4	
" "	" "	" 26	5,740	6.5	12.2	99.4	0.8 0.8*	1	4.4			

TABLE Mo-7 MONONGAHELA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth		Date 1940		Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml.	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
							p.p.m.	% Sat.						
Monongahela River Lock & Dam No. 7 Greensboro, Pa.	Mo	84.8	Dec.	5	4,060	4.0	13.2	100.6	0.5 0.4*	2	4.2			
" "	"	"	"	9	5,300	4.0	12.8	97.3	0.6 0.6*	3	4.1			
Muddy Creek Upper Edge of Fairchance, W. Va.	MoGeMu	96	Aug.	22	**	18.0	8.8	92.5	0.3	23	7.1		20	
" "	"	"	Oct.	10	**	10.0	10.7	94.4	1.2	110	6.9		24	
" "	"	"	Nov.	15	1	5.0	11.7	91.6	0.8	75	6.3		16	
Muddy Creek below Fairchance, W. Va.	MoGeMu	95	Aug.	22	1	18.5	8.9	94.5	0.5 0.6*	4	3.9	3		124
" "	"	"	Oct.	10	1	9.5	10.2	89.2	0.9 0.9*	**	5.3		4	164
" "	"	"	Nov.	15	6	4.0	11.6	88.0	0.6 0.8*	46	5.3	6		93
Georges Creek Below mouth of Muddy Run	MoGe	94.6	Aug.	22	**	17.0	8.8	90.9	1.7	23	7.2	3	34	42
" "	"	"	Oct.	10	1	9.0	9.6	83.1	3.4	240	7.1	5	36	74
" "	"	"	Nov.	15	4	4.5	10.9	84.2	2.3	2,400	6.3	4	23	61
Georges Cr. ½ mile below Smithfield, Pa.	MoGe	91.5	Aug.	23	1	18.0	7.0	73.1	0.6 0.4*	1	3.6	3		144
" "	"	"	Oct.	11	1	9.0	9.1	78.1	1.4 0.8*	1	4.2	7		267
" "	"	"	Dec.	3	10	0.0	12.9	83.3	0.8 0.9*	4	5.6	10		89
Jacobs Creek Greensboro, Pa.	MoJa	84	Oct.	2	2	12.0	9.5	87.5	3.3 2.4*	46	6.9	500	22	562
" "	"	"	"	8	2	14.0	8.9	85.5	0.5 0.8*	9	4.2	9		429
Cats Creek Upper Edge of Masontown, Pa.	MoCa	83	Aug.	23	**	16.5	6.8	69.5	1.6	93	7.1		42	
" "	"	"	Oct.	11	**	8.5	8.7	73.9	2.7	240	7.1	180	46	63
" "	"	"	Dec.	3	**	0.0	12.5	85.2	1.8	43	7.0		26	
Cats Creek ½ mile below Masontown, Pa.	MoCa	81	Aug.	23	1	18.0	8.0	83.4	6.7 1.6*	**	2.5	17		1,420
" "	"	"	Oct.	11	1	10.5	10.8	96.3	0.2* 14.2	**	2.5			
" "	"	"	Dec.	3	1	0.0	14.7	100.6	5.8 3.5*	36	2.9	47		1,360
Big Run at mouth Masontown, Pa.	MoBi	78.5	Aug.	23	**	16.5	3.0	30.6	15.3	1,100	7.5	258	184	
" "	"	"	Oct.	11	**	9.5	5.1	44.5	24.2	4,600	7.6	10	251	165
" "	"	"	Dec.	3	1	1.0	10.9	76.8	3.6	930	7.6	5	181	203
Monongahela River Dam No. 6 Rice Landing, Pa.	Mo	68.3	Aug.	19	670	26.5	7.2	88.2	0.4* 0.3	**	3.3			
" "	"	"	"	27	1,280	22.5	7.7	88.3	0.3* 0.7	4	3.2			
" "	"	"	Sept.	4	2,610	22.5	7.9	90.4	0.8 0.6*	**	3.8			
" "	"	"	"	13	1,490	20.5	8.0	88.1	1.0 0.6*	**	3.3			
" "	"	"	"	17	1,300	20.0	8.2	90.0	0.2* 1.1	**	3.4			
" "	"	"	Sept.	24	860	21.5	8.0	90.3	0.5* 0.5	**	3.3			
" "	"	"	Oct.	2	2,340	16.5	8.7	88.6	0.5* 1.1	**	3.5			
" "	"	"	"	8	1,800	17.0	8.7	89.5	0.7* 0.6	1	3.8			
" "	"	"	"	17	1,200	15.0	9.2	90.4	0.7* 0.9	**	3.6			
" "	"	"	"	22	1,380	12.5	9.8	91.9	0.9* 1.2	**	3.6			
" "	"	"	"	30	1,740	13.0	9.9	93.1	1.4* 2.6	9	3.6			

TABLE Mo-7 MONONGAHELA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth		Date 1940	Average Discharge c. f. s.	Temp. °C	Dissolved Oxygen		5 Day B. O. D. p. p. m.	Coliforms M. P. N. Per ml.	pH	Turbidity p. p. m.	Alkalinity p. p. m.	Hardness p. p. m.
						p. p. m.	% Sat.						
Monongahela River Dam No. 6 Rice Landing, Pa.	Mo	68.3	Nov. 4	7,560	13.0	9.9	93.8	1.1 1.2*	**	4.5			
" "	"	"	" 12	2,400	10.5	10.7	95.1	1.0	**	6.5		7	
" "	"	"	" 20	3,240	7.0	11.4	93.6	0.8 1.2*	**	4.2			
" "	"	"	" 26	8,610	7.0	11.7	96.4	0.8 1.0*	**	4.2			
" "	"	"	Dec. 5	5,140	4.0	12.6	96.0	0.7 0.5*	**	5.5			
" "	"	"	" 9	5,530	4.0	12.5	95.0	0.8 0.6*	1	4.3			
S.Fk.Ten Mile Creek Upper Edge of town Waynesburg, Pa.	MoTeSf	85.5	Aug. 21	2	20.5	6.0	65.7	1.6	93	7.6		117	
" "	"	"	Sept. 27	30	14.0	8.5	81.9	1.0	46	7.5		89	
" "	"	"	Nov. 8	41	5.5	11.1	87.8	1.3	46	7.3		69	
S.Fk.Ten Mile Creek ½ mile below Waynesburg, Pa.	MoTeSf	83.5	Aug. 21	5	22.0	0.4	5.0	9.2	110,000	7.4		128	
" "	"	"	Sept. 27	33	13.5	7.6	72.4	6.3	2,400	7.5		94	
" "	"	"	Nov. 8	45	6.5	10.8	87.7	2.9	9,300	7.2		72	
Ten Mile Creek Upper Edge of Marianna, Pa.	MoTe	75.5	Aug. 21	4	20.5	6.7	73.5	1.2	23	7.6		108	
" "	"	"	Sept. 27	18	11.5	9.0	82.0	1.1	150	7.7		131	
" "	"	"	Nov. 8	35	5.0	11.2	87.3	1.4	4	7.7		118	
Ten Mile Creek ½ mile below Marianna, Pa.	MoTe	74	Aug. 21	7	20.5	6.7	73.3	3.0	1,100	7.5	27	114	144
" "	"	"	Sept. 27	21	12.0	9.4	86.3	2.5	2,400	7.6	14	132	150
" "	"	"	Nov. 8	38	6.5	11.5	93.6	2.0	91	7.6	5	122	128
Monongahela River Dam No. 5 Brownsville, Pa.	Mo	56.5	Aug. 19	730	26.0	7.3	88.8	0.5 0.5*	2	3.7			
" "	"	"	" 27	1,600	22.5	7.8	89.1	0.5 0.2*	4	3.5			
" "	"	"	Sept. 4	2,820	22.0	8.0	90.8	0.6 0.8*	4	5.0			
" "	"	"	" 13	1,700	20.5	8.3	91.4	1.2 0.7*	**	4.1			
" "	"	"	" 17	1,590	20.0	8.3	90.1	0.9 2.7*	2	4.0			
" "	"	"	" 24	1,590	21.0	8.1	90.2	0.7* 0.1	**	3.6			
" "	"	"	Oct. 2	2,570	17.5	8.8	91.2	0.7 0.6*	2	4.4			
" "	"	"	Oct. 8	2,210	14.5	8.8	85.9	1.1 0.7*	**	3.9			
" "	"	"	" 17	1,150	15.0	8.7	86.1	1.0 0.8*	1	3.9			
" "	"	"	" 22	1,600	12.0	9.7	89.6	0.8* 1.5	**	3.8			
" "	"	"	" 30	2,100	12.5	10.2	95.3	1.5* 2.1	2	3.8			
" "	"	"	Nov. 4	9,760	12.5	10.0	93.0	1.6 1.6*	**	4.7			
" "	"	"	" 12	2,980	10.0	10.8	95.0	1.2	**	6.8		10	
" "	"	"	20	3,850	7.0	11.4	93.8	0.7	**	6.5		7	
" "	"	"	" 26	9,300	7.0	11.5	94.6	0.8 0.8*	**	4.3			
" "	"	"	Dec. 5	5,550	4.5	12.5	96.1	0.3 0.4*	**	5.7			
" "	"	"	" 9	5,980	3.5	12.2	91.8	0.6	1	6.2		7	
Dunlap Creek ½ mile below mine Fairbank, Pa.	MoDu	67	Aug. 23	3	17.0	4.6	47.0	1.0	43	6.6	170	52	648
" "	"	"	Oct. 11	2	14.5	7.1	69.0	6.7 2.3*	4	7.0	160	79	740
" "	"	"	Dec. 3	7	4.5	10.1	78.2	1.7	240	6.9	85	85	304

TABLE No-7 MONONGAHELA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Dunlap Cr. ½ mile below Republic, Pa.	MoDu 65	Aug. 23	5	17.0	0.1	1.1	8.0	230	6.5		103	
" "	" "	Oct. 11	10	12.5	4.3	39.9	10.2 1.5*	36	6.2		55	
" "	" "	Dec. 3	26	4.0	8.2	62.8	2.3 1.3*	43	6.9	85	103	
Redstone Creek Below Brownfield	MoRe 76	Aug. 22	**	16.0	8.1	81.6	0.9	3	6.3		10	
" "	" "	Oct. 10	**	8.5	10.0	85.3	1.0	**	6.5		7	
" "	" "	Nov. 15	1	5.0	11.3	88.4	1.3	2	6.7		21	
Redstone Creek Above Treatment Plant Uniontown, Pa.	MoRe 73	Aug. 22	4	15.0	3.9	38.0	4.1 2.1*	**	2.9			
" "	" "	Oct. 10	6	10.0	7.2	63.8	0.4* 7.4	**	3.2			
" "	" "	Nov. 15	15	8.0	7.9	66.8	34.3 4.9*	**	3.3			
Redstone Creek Below Treatment Plant Uniontown, Pa.	MoRe 71	Aug. 22	8	16.0	9.9	99.3	9.2 6.6*	**	3.1	130		1,180
" "	" "	Oct. 10	8	6.5	6.7	54.0	14.4 11.6*	**	3.1	155		972
" "	" "	Nov. 15	25	7.5	7.9	66.1	23.9 5.7*	1	3.5	180		776
Cove Run at mouth Uniontown, Pa.	MoReC 72.5	Aug. 22	1	15.0	3.7	36.2	17.5	4,600	7.6	17	202	195
" "	" "	Oct. 10	1	8.5	4.0	34.4	5.0	2,400	7.5	8	170	178
" "	" "	Nov. 15	7	4.5	8.5	65.2	3.3	2,400	7.1	5	89	148
Monongahela River Dam No. 4 Charleroi, Pa.	Mo 41.5	Aug. 19	760	26.0	7.2	87.7	0.8 0.5*	1	3.3			
" "	" "	" 27	1,910	22.5	8.4	96.5	0.4* 1.0	2	3.3			
" "	" "	Sept. 4	2,900	21.5	8.2	92.1	1.4	75	6.3	64	24	82
" "	" "	" 13	1,680	20.0	8.6	93.2	0.9 0.5*	2	3.9	20		
" "	" "	" 17	1,340	19.5	8.4	91.1	0.7 0.7*	**	3.7	6		
" "	" "	" 24	900	21.0	7.9	87.3	0.8 0.5*	24	3.7	8		
" "	" "	Oct. 2	2,550	17.5	9.0	93.3	1.3 0.5*	1	3.8	8		
" "	" "	" 8	2,220	17.2	8.8	91.2	1.1 0.7*	3	3.6	7		168
" "	" "	" 17	1,010	15.0	9.4	92.1	0.8 0.6*	2	3.5	5		80
" "	" "	" 22	1,650	11.5	10.2	93.5	1.0* 1.4	2	3.5	6		92
" "	" "	" 30	2,150	12.0	8.4	77.2	2.2 0.8*	4	3.5	5		81
" "	" "	Nov. 4	11,600	12.5	10.0	93.7	1.2 1.0*	**	4.6	4		67
" "	" "	" 12	2,570	10.0	10.7	94.2	1.2	1	6.1	8	4	79
" "	" "	" 20	4,650	7.0	11.4	93.3	0.3 1.0*	**	4.3	5		80
" "	" "	" 26	10,600	7.0	11.2	92.2	1.2 1.1*	4	4.1	16		87
" "	" "	Dec. 5	5,910	4.5	12.5	96.3	1.4 1.6*	**	5.7	10		72
" "	" "	" 9	6,040	4.0	12.1	91.9	0.8 1.1*	1	4.6	8		88
Pigeon Cr. 3/4 mile below Cokeburg, Pa.	MoPi 43.5	Aug. 21	**	17.0	8.6	88.1	2.0	240	7.6		141	
" "	" "	Sept. 27	1	9.5	10.5	92.0	2.0	93	7.6		137	
" "	" "	Nov. 8	2	4.5	11.9	91.6	1.4	43	7.7		123	
Pigeon Cr. upper edge of Ellsworth, Pa.	MoPi 42.5	Aug. 21	2	18.5	4.4	46.3	1.8	9	7.5		127	
" "	" "	Sept. 27	5	9.5	8.8	76.7	2.1		7.6		125	
" "	" "	Nov. 8	5	5.5	10.4	82.0	2.3	9	7.3		122	

TABLE No-7 MONONGAHELA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth		Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Pigeon Cr. Upper edge of Bentleyville, Pa.	MoPi	42	Aug. 21	3	17.5	8.4	86.6	2.5	1,100	7.6		125	
" "	"	"	Sept. 27	5	9.5	9.4	81.6	3.0	240	7.5		150	
" "	"	"	Nov. 8	8	5.5	10.9	86.2	2.0	460	7.4		126	
Pigeon Creek Below Last Sewer Bentleyville, Pa.	MoPi	37.5	Aug. 21	3	15.5	8.7	86.3	1.9	240	7.5	8	114	231
" "	"	"	Sept. 27	5	9.0	9.9	85.1	3.0	1,100	7.6	17	118	202
" "	"	"	Nov. 8	9	5.0	11.3	86.0	2.0	230	7.4	37	108	178
N.Fk. Pigeon Creek At mouth Bentleyville, Pa.	MoPiNf	40	Aug. 21	**	15.0	7.8	77.2	0.5	4	6.6	76	232	250
" "	"	"	Sept. 27	1	8.5	6.1	68.8	7.1 2.4*	**	4.6	120		954
" "	"	"	Nov. 8	3	4.5	12.1	93.3	2.1	9	7.5	12	139	158
Monongahela River Dam No. 2 McKeesport, Pa.	Mo	23.8	Sept. 25	2,100	22.0	8.1	91.7	0.9 0.8*	**	3.7			
" "	"	"	Oct. 4	2,200	17.5	8.6	88.9	1.6 1.2*	4	3.7			
" "	"	"	" 9	2,230	17.0	8.6	88.3	1.3 1.1*	1	3.5			
" "	"	"	Oct. 18	1,900	15.0	9.1	89.3	1.1 1.2*	**	3.5			
" "	"	"	" 23	1,900	12.5	8.9	83.4	1.6 1.1*	**	3.5			
" "	"	"	Nov. 1	8,360	13.0	9.8	92.8	1.9 1.4*	**	3.4			
" "	"	"	" 6	8,200	12.0	9.7	89.6	1.8	2	6.2		5	
" "	"	"	" 13	3,250	10.0	10.2	90.2	1.0 0.8*	**	4.6			
" "	"	"	" 27	22,600	7.0	11.2	91.6	1.8 1.0*	8	5.5			
" "	"	"	Dec. 4	13,600	3.0	12.4	92.0	0.9	4	6.2		7	
" "	"	"	" 10	21,100	5.0	12.3	96.2	1.6 1.1	1	5.5			
Monongahela River Bridge above mouth of Youghiogheny River	Mo	16.4	Aug. 19	780	28.0	2.3	29.0	0.5 0.3*	**	3.9			
" "	"	"	" 27	1,960	23.5	3.4	39.5	1.2 0.4*	2	3.7			
" "	"	"	Sept. 5	2,950	23.0	7.2	82.4	0.6 0.5*	2	4.5			
" "	"	"	" 16	720	20.5	7.2	79.2	1.1 0.8*	**	3.9			
Snowy Creek Corinth, W. Va.	MoYoS	135	June 18	86	19.0	7.8	83.1	1.5 1.6*	1,100	5.5	77	19	31
" "	"	"	" 24	18	17.5	8.3	85.8	0.5	240	6.1	22	20	33
" "	"	"	July 8	21	14.5	9.3	90.4	0.4	91	6.2	14		24
Youghiogheny River Bridge at lower edge of Oakland, Md.	MoYo	127.5	June 18	374	20.0	7.6	82.4	0.5 0.9*	93	5.1	38	16	31
" "	"	"	" 24	390	16.0	8.2	86.1	0.4 0.7*	43	5.5	14	17	36
" "	"	"	July 8	133	16.0	8.7	87.8	0.6 0.5*	9	4.4	10		
Youghiogheny River Above Confluence, Pa.	MoYo	88	July 16	378	20.5	8.4	92.3	0.8 0.4*	**	5.1		8	
" "	"	"	" 25	258	24.0	7.8	91.7	0.2 0.3*	1	5.6			
" "	"	"	Aug. 6	291	25.0	7.3	86.9	0.3 0.4*	15	4.6			
Casselman River Bridge above town Meyersdale, Pa.	MoYoCa	116	July 15	61	18.5	8.1	86.2	1.5 0.2*	**	3.3			
" "	"	"	" 24	122	21.5	7.4	83.4	0.4 0.6*	110	4.5			
" "	"	"	" "	33	21.5	7.3	81.6	1.9 0.3*	4	3.1			
Casselman River ½ mile below Meyersdale, Pa.	MoYoCa	113	July 15	73	18.0	8.6	89.9	1.0 0.4*	9	3.0			
" "	"	"	" 24	125	21.5	7.4	83.2	0.6 1.6*	46	3.6			
" "	"	"	Aug. 2	35	20.0	8.3	90.9	0.7 0.5*	4	3.1			

TABLE No-7 MONONGAHELA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Casselman River Above Garrett, Pa.	MoYoCa 111	July 15	82	19.0	8.2	88.0	0.4 0.4*	**	3.0			
" "	" "	" 24	140	21.5	7.3	82.3	0.9 1.4*	46	3.4			
" "	" "	Aug. 2	38	20.5	7.6	84.0	0.4 0.4*	4	3.0			
Buffalo Creek At mouth Garrett, Pa.	MoYoCaB-111	July 15	13	17.0	9.0	92.2	0.7 0.5*	240	3.5	14		
" "	" "	" 24	13	21.5	8.2	92.1	0.5 1.2*	75	4.1	4		
" "	" "	Aug. 2	6	17.5	8.9	92.5	0.4 0.5*	93	3.8	2		
Casselman River 2 miles below Garrett, Pa.	MoYoCa 109	July 15	96	19.5	8.4	90.9	0.6 0.6*	**	3.2	5		
" "	" "	" 24	150	22.5	7.6	86.9	1.3 1.7*	110	3.5	10		
" "	" "	Aug. 2	44	20.5	8.2	90.6	0.4 0.2*	4	3.0	4		
Casselman River Above Rockwood, Pa.	MoYoCa 105.5	July 16	250	19.5	8.4	90.7	1.0 0.5*	9	3.4			
" "	" "	" 25	142	25.0	7.5	89.3	0.6 0.1*	**	3.5			
" "	" "	Aug. 6	40	23.0	7.9	91.2	0.5 0.2*	**	2.9			
Coxes Creek Above Treatment Plant	MoYoCaC-114	July 15		19.5	6.4	69.2	0.8	150	6.6		26	
" "	" "	" 24	9	23.0	0.9	10.8	3.4	2,400	6.3		38	
" "	" "	Aug. 2	1	19.5	10.0	107.9	0.7	23	7.4		35	
Coxes Creek Below Treatment Plant Somerset, Pa.	MoYoCaC-111	July 15	8	20.5	6.9	76.1	1.3	91	6.7	18	24	71
" "	" "	" 24	10	23.5	1.8	20.5	2.9	2,400	6.4	135	44	77
" "	" "	Aug. 2	2	19.5	1.6	17.7	47.4	4,600	6.8	80	87	
Coxes Creek at mouth Rockwood, Pa.	MoYoCaC 104.5	July 16	93	19.0	8.8	94.2	0.9 0.6*	23	5.2	60	8	
" "	" "	" 25	32	23.5	8.1	94.3	0.5	93	6.8	10	23	68
" "	" "	Aug. 6	4	21.5	7.6	85.1	0.9 0.3*	46	3.6	4		
Casselman River Br. bel. town Rockwood, Pa.	MoYoCa 104	July 16	343	20.0	8.6	93.2	1.0 0.4*	24	3.9			
" "	" "	" 25	174	25.0	7.9	93.9	0.5 0.2*	46	3.8			
" "	" "	Aug. 6	45	23.5	8.1	93.8	0.6 0.2*	**	2.9	2		
Casselman River at mouth Confluence, Pa.	MoYoCa 87	July 16	322	20.0	8.6	93.8	0.7 0.4*	9	3.9	7		
" "	" "	" 25	248	23.0	8.0	92.6	0.3 0.2*	2	3.9	3		
" "	" "	Aug. 6	87	23.5	7.9	91.5	0.5 0.1*	**	3.7	3		
Laurel Hill Creek At mouth Confluence, Pa.	MoYoLa 86.5	July 16	230	19.0	8.7	93.4	0.7	460	7.0	50	23	31
" "	" "	" 25	75	23.5	8.2	95.8	0.3	4	7.0	4	17	28
" "	" "	Aug. 6	32	22.5	7.8	89.3	0.2	4	6.9	7	17	31
Youghiogheny River 1 mile below Confluence, Pa.	MoYo 84.5	July 16	930	21.0	8.4	93.0	0.4 0.5*	46	5.1	8	7	
" "	" "	" 25	581	25.0	7.9	94.3	0.7 0.3*	4	5.6	4		
" "	" "	Aug. 6	410	25.5	7.3	88.3	0.6 0.3*	15	4.7	5		
Youghiogheny River Water Plant [illegible] Above Connellsville, Pa.	MoYo 59	Aug. 30	2,470	19.0	8.8	93.8	0.6	24	6.8		8	
" "	" "	Oct. 1	308	13.0	9.5	89.8	0.5	**	6.9		6	
" "	" "	Nov. 18	1,005	2.0	13.2	95.1	1.1	**	7.1		8	

TABLE No-7 MONONGAHELA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliform M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Mounts Creek at mouth Connellsville, Pa.	MoYoM 58	Aug. 30	3	20.5	8.5	93.4	0.6	1,100	7.4	4	31	124
" "	" "	Oct. 1	3	12.0	10.0	92.0	0.6	43	7.3	3	24	129
" "	" "	Nov. 18	10	1.0	13.3	93.3	2.2	460	7.3	5	32	80
Youghiogheny River ½ mile below Connellsville, Pa.	MoYo 57	Aug. 30	2,490	19.5	8.4	90.5	2.0	2,400	6.7	16	12	32
" "	" "	Oct. 1	308	13.0	9.7	91.4	0.4	36	7.0	4	2	42
" "	" "	Nov. 18	1,020	2.0	13.2	95.2	1.6	1,100	6.9	3	12	42
Dickerson Run ½ mile above Vanderbilt, Pa.	MoYoD 53.5	Dec. 3	2	1.5	13.2	94.2	1.0	9	7.4		168	
Dickerson Run Upper Edge of Vanderbilt, Pa.	MoYoD 53	Aug. 30	14	15.5	8.7	93.7	0.7	240	7.0		58	
" "	" "	Oct. 1	**	11.0	9.5	85.5	3.5 3.0*	23	4.6			
" "	" "	Nov. 18	**	1.5	13.3	94.9	2.6	2,400	7.9		144	
Dickerson Run W. Branch Upper edge of Vanderbilt, Pa.	MoYoDWb-53	Dec. 3	**	1.5	13.0	92.7	1.8 2.2*	460	5.6	16		309
Dickerson Run 1 mile below town Vanderbilt, Pa.	MoYoD 52	Aug. 30	2	19.5	8.5	92.1	1.0	2,400	7.6	20	74	224
" "	" "	Oct. 1	**	11.5	9.5	86.5	0.9	36	7.4	4	46	294
" "	" "	Nov. 18	1	2.0	13.0	93.6	2.0	460	7.5	6	86	267
" "	" "	Dec. 3	3	0.0	13.1	89.5	4.6	1,100	7.3	40	115	230
Washington Run ½ mile above town Star Junction, Pa.	MoYoW 51	Aug. 30	**	20.0	6.9	75.4	1.3	240	7.5		22	
" "	" "	Oct. 1	**	12.0	6.7	61.8	1.6	23	7.5		230	
" "	" "	Nov. 18	**	5.0	9.3	73.0	1.2	4	7.5		205	
Washington Run ½ mile below Star Junction, Pa.	MoYoW 49.5	Aug. 30	**	20.5	7.2	79.7	1.1 0.9*	7	4.8	27		268
" "	" "	Oct. 1	**	12.5	6.6	61.5	0.9	23	6.7	14	32	273
" "	" "	Nov. 18	1	4.0	9.5	72.4	2.8	24	6.5	17	41	270
Shutes Run Upper edge of town Mount Pleasant, Pa.	MoYoJaS 62	Sept. 3	1	19.5	5.1	55.5	5.6	2,400	6.9		76	
" "	" "	" 26	1	10.5	8.4	74.8	2.8	1,100	7.1		104	
Shutes Run ½ mi. bel. last sewer Mount Pleasant, Pa.	MoYoJaS 60	Sept. 3	1	18.5	0.0	00.0	147	240,000	7.3	170	187	266
" "	" "	" 26	2	11.0	4.2	38.3	62.4	46,000	7.4	115	169	265
Jacob Creek upper edge of Scottdale, Pa.	MoYoJa 55.5	Sept. 3	13	19.0	6.6	70.4	1.0	23	6.3		20	
" "	" "	" 26	31	12.5	8.5	79.1	1.9	93	6.8		16	
Jacob Creek ½ mile below Scottdale, Pa.	MoYoJa 53	Sept. 3	17	18.5	4.7	50.2	1.0 1.1*	7	5.4	14		
" "	" "	" 26	37	12.0	8.0	74.3	2.1	75	6.4	14	9	94
Youghiogheny River Upper Edge of West Newton, Pa.	MoYo 35	Sept. 19	845	18.0	8.1	84.9	0.4 0.6*	**	4.5			
" "	" "	Nov. 7	3,150	7.0	10.9	89.4	1.8	46	7.2			
" "	" "	Dec. 2	5,720	2.5	12.6	91.9	1.6	24	6.6		13	
Youghiogheny River ½ mile below W. Newton, Pa.	MoYo 33	Sept. 19	845	18.0	8.2	85.7	0.6 0.5*	1	4.5	6		77
" "	" "	Nov. 7	3,150	7.5	10.7	89.1	1.9	46	7.1	4	6	51
" "	" "	Dec. 2	5,720	2.5	12.6	92.2	0.8	24	6.7	4	7	45

TABLE Mo-7 MONONGAHELA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliform M.P.N. Per ml	pH	Turbidity p.p.m.	alinity p.p.m.	Hardness p.p.m.
Jacks Run Lower Edge of Greensburg, Pa.	MoYoSJ 58	Sept. 18	6	16.0	22.4	224.6	3.3 0.8*	**	2.7			
" "	" "	Oct. 29	**	8.5	6.1	52.0	17.4 4.2*	**	2.9			
Jacks Run above mouth Slate Creek Greensburg, Pa.	MoYoSJ 53.5	Oct. 15	10	15.5	12.8	127.3	160.8 22.0*	36	3.5	220		2,400
" "	" "	" 25		12.5	5.3	49.5	140.0 74.0*	36	3.5	180		2,820
" "	" "	Nov. 1	10	13.5	0.0	00.0	161.0 170.0*	240,000	6.3	950	51	296
" "	" "	" 7	10	11.0	9.2	83.1	148.4 53.4*	23	3.5	180		2,260
" "	" "	" 15	9	9.5	14.4	125.6	116.0 33.6*	2	3.5	190		2,510
" "	" "	" 22	9	15.0	13.2	130.0	138.8 40.0*	2	3.5	150		2,380
" "	" "	" 28	19	6.5	7.7	62.8	72.0 17.5*	360	4.4	70		1,540
" "	" "	Dec. 2	18	5.5	10.6	83.6	112.8 31.8*	23	4.1	110		1,670
Slate Creek At mouth Greensburg, Pa.	MoYoSJS 54.5	Oct. 15	1	13.5	0.0	00.0	45.9	15,000	7.2	75	107	101
" "	" "	" 25		9.5	2.4	21.2	29.6	9,300	6.9	80	86	99
" "	" "	Nov. 1	6	10.5	6.6	58.9	26.8	2,400	6.9	70	59	96
" "	" "	" 7	6	8.5	10.4	88.8	6.8	430	7.3	10	50	80
" "	" "	Nov. 15	3	5.0	10.5	81.9	14.5	11,000	6.9	9	57	136
" "	" "	" 22	3	12.0	8.6	79.2	14.8	4,600	7.2	32	66	116
" "	" "	" 28	23	3.5	11.8	88.8	4.8	390	6.9	22	27	88
" "	" "	Dec. 2	5	2.5	12.0	87.6	17.9	1,500	7.0	24	46	
Jacks Run Below Slate Run Below Greensburg, Pa.	MoYoSJ 53	Sept. 18	11	13.0	6.8	64.1	4.6 1.6*	**	3.1	320		
" "	" "	" 24	7	14.5	6.6	64.3	5.6 4.6*	1	3.5	125		758
" "	" "	" 24	7	19.0	0.0	00.0	184.5 138.4*	2,400	4.7	1,500		384
" "	" "	" 27	8	10.5	7.1	62.9	6.8 5.3*	**	3.3	90		1,810
" "	" "	" 27	7	17.5	10.6	109.9	4.7 6.5*	4	3.3	72		2,040
" "	" "	Oct. 29	4	11.0	5.6	50.4	37.2 32.0*	4	3.3	145		852
Jacks Run upper edge of Youngwood, Pa.	MoYoSJ 52.5	Sept. 3	13	16.5	0.9	8.8	12.9	36	6.3		5	
" "	" "	" 26	16	10.0	8.6	75.7	8.6 7.8*	24	6.0		19	
Jacks Run below last sewer Youngwood, Pa.	MoYoSJ 51	Sept. 3	15	16.5	1.0	9.6	13.1	1,500	6.4	88	3	316
" "	" "	" 26	17	10.0	9.0	79.1	9.0 7.4*	93	6.0	125	12	472
Sewickley Creek Above mouth Jacks Run Youngwood, Pa.	MoYoS 51	Sept. 3	28	15.5	7.8	77.3	7.2 1.7*	**	3.3	190		
" "	" "	" 26	36	10.0	9.6	84.7	8.6 2.2*	**	3.7	200		
Youghiogheny River Bridge above Versailles, Pa.	MoYo 20	Sept. 19	865	18.0	7.8	81.8	0.7 0.6*	2	3.8			
" "	" "	Nov. 7	3,210	6.5	10.6	86.4	1.3	16	7.0		8	
" "	" "	Dec. 2	5,770	1.5	12.2	86.9	0.2	21	6.2		9	
Youghiogheny River 1 mile below Versailles, Pa.	MoYo 18	Sept. 19	865	18.5	7.6	80.5	0.6 0.6*	2	3.8			
" "	" "	Nov. 7	3,210	6.5	10.4	84.7	1.8	4	7.1		5	
" "	" "	Dec. 2	5,780	2.0	12.2	88.1	0.7	24	6.2		8	

TABLE No-7 MONONGAHELA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Youghiogheny River at mouth McKeesport, Pa.	MoYo 16.3	Aug. 19	425	25.0	6.2	73.7	1.4 0.4*	2	3.5	17		
" "	" "	" 27	3,200	18.5	7.2	76.1	1.0 0.4*	8	3.5	75		
" "	" "	Sept. 5	1,050	21.0	7.4	81.8	0.2 0.4*	2	4.1	18		
" "	" "	" 16	875	18.0	7.6	79.1	1.4 1.0*	110	4.0	14		
" "	" "	" 25	490	17.0	7.2	74.0	1.2 1.0*	2	3.4	7		
" "	" "	Oct. 4	883	15.0	8.6	84.5	1.1 0.6*	1	3.1	20		
" "	" "	" 9	610	14.5	8.4	81.5	1.1 0.5*	**	3.3	8		220
" "	" "	" 18	530	11.0	8.6	77.7	3.5 1.2*	24	3.6	140		
" "	" "	" 23	485	9.5	10.1	88.2	1.1 0.6*	**	4.0	14		186
" "	" "	Nov. 1	2,550	10.5	9.7	86.9	1.5 1.2*	4	4.6	18		94
" "	" "	" 6	2,800	9.0	10.6	91.7	1.0	2	6.9	14	6	66
" "	" "	" 13	1,480	7.5	9.5	79.3	0.8 0.7*	2	4.5	14		157
" "	" "	" 27	5,280	9.0	10.6	91.6	1.4	15	6.2	105	13	90
" "	" "	Dec. 4	3,420	0.0	13.1	89.6	0.6	2	6.2	55	9	118
" "	" "	" 10	3,830	5.0	12.1	94.7	0.6	4	6.2	50	10	124
Brush Creek upper edge of Jeanette, Pa.	MoTuB 31	Sept. 18	1	17.0	9.5	97.3	0.8	15	7.7		44	
" "	" "	Oct. 29	**	8.5	10.3	87.9	6.1	46	7.3		56	
Brush Creek Above Treatment Plant Jeanette, Pa.	MoTuB 28	Oct. 29	2	16.5	2.1	21.0	85.8	24,000	7.9	95	146	111
Brush Creek 200' below Treatment Plant Jeanette, Pa.	MoTuB 27.5	Sept. 18	7	22.0	1.0	11.1	53.3	46,000	7.1	41	141	110
" "	" "	Oct. 29	5	13.5	0.0	00.0	50.7	110,000	7.3		182	
Brush Creek Above Irwin, Pa.	MoTuB 25	Sept. 19	13	15.0	7.9	82.6	6.8 6.2*	**	3.2			
" "	" "	Nov. 7	12	6.5	10.8	87.9	2.5 3.4*	24	3.3			
" "	" "	Dec. 2	30	2.5	11.8	86.4	2.1 2.1*	240	3.5			
Brush Creek ½ mile below Irwin, Pa.	MoTuB 23	Sept. 19	15	16.5	7.7	78.4	6.2 4.8*	2	3.6	225		557
" "	" "	Nov. 7	18	8.0	10.2	85.8	15.4 5.7*	8	3.4	190		704
" "	" "	Dec. 2	38	4.5	11.4	87.7	9.1 3.9*	240	3.8	150		382
Turtle Creek upper edge of Export, Pa.	MoTu 28	Sept. 18	1	18.5	6.4	67.7	5.6 1.0*	**	2.8			
" "	" "	Oct. 29	**	6.5	8.4	71.8	4.8 2.5*	**	3.1			
Turtle Creek 3/4 mile below Export, Pa.	MoTu 25.5	Sept. 18	4	14.0	7.5	74.8	2.5 0.4*	**	2.9	87		472
" "	" "	Oct. 29	2	9.0	9.7	83.4	2.4 1.6*	**	3.1	16		599
Turtle Creek above all sewage above Trafford, Pa.	MoTu 18.5	Sept. 6	10	21.5	8.2	93.3	0.7 0.6*	**	2.9			
" "	" "	Oct. 25	5	8.5	11.1	94.5	0.9 1.1*	**	3.2			
" "	" "	Nov. 28	165	2.0	12.5	90.6	0.8	4	6.0		4	
Turtle Creek above mouth Brush Creek below Trafford, Pa.	MoTu 17.5	Sept. 6	12	21.0	4.0	44.3	5.0 6.9*	240	3.3			
" "	" "	Oct. 28	6	10.5	8.3	74.4	17.0 17.2*	150	3.5			
" "	" "	Nov. 28	170	2.0	12.6	91.4	1.9	430	6.0		5	
Turtle Cr. upper edge of Pitcairn, Pa.	MoTu 15	Sept. 6	38	20.0	5.4	58.5	6.4 7.4*	**	3.3			
" "	" "	Oct. 28	153	8.5	8.9	76.0	10.1 2.6*	**	3.2			
" "	" "	Nov. 28	309	2.5	12.2	84.1	1.2	91	6.1		7	

TABLE No-7 MONONGAHELA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth		Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
						p.p.m.	% Sat.						
Turtle Creek upper edge of Turtle Creek, Pa.	MoTu	14.5	Sept. 6	53	19.0	4.1	44.2	6.0 5.9*	**	2.9			
" "	"	"	Oct. 28	31	9.5	9.7	84.9	10.8 6.0*	**	2.9			
" "	"	"	Nov. 28	314	2.5	12.3	90.0	2.1	1,100	6.2		8	
Turtle Creek ½ mile above mouth Turtle Creek, Pa.	MoTu	12	Sept. 6	56	24.0	2.8	33.2	5.1 15.0*	4	2.9	47		451
" "	"	"	Oct. 28	34	13.0	5.5	51.9	12.7 14.6*	2	3.2	65		478
" "	"	"	Nov. 28	321	3.0	11.6	85.7	3.3	36	6.2	65	9	199
Monongahela River Dam No.2 Pittsburgh, Pa.	Mo	11.2	Aug. 19	1,200	19.0	5.4	57.5	0.6 0.2*	1	3.5	8		
" "	"	"	" 27	5,200	24.0	6.0	70.0	0.7 0.5*	46	3.7	3		
" "	"	"	Sept. 5	4,060	23.5	7.3	84.7	1.3 1.0*	4	3.9	8		
" "	"	"	" 16	1,650	21.0	7.1	79.3	1.4 1.2*	9	3.9			
" "	"	"	" 25	2,620	23.0	6.0	69.5	1.7 1.5*	9	4.0			
" "	"	"	Oct. 4	3,090	19.0	7.3	78.4	1.4 1.0*	2	3.7			
" "	"	"	" 9	2,840	20.0	6.1	66.5	1.4 1.0*	3	3.8			159
" "	"	"	" 18	2,450	18.5	6.4	67.9	2.2 1.5*	2	3.7			
" "	"	"	Oct. 23	2,450	13.5	7.6	72.1	1.8 1.0*	**	3.7			
" "	"	"	Nov. 1	12,400	13.5	9.1	86.5	2.4 1.8*	24	3.4			
" "	"	"	" 6	11,130	12.5	9.4	88.0	1.1		5.7		5	
" "	"	"	" 13	4,800	10.7	9.1	81.4	1.8 1.3*	14	4.2			
" "	"	"	" 27	29,500	6.5	10.7	86.9	1.5 1.3*	4	5.3			
" "	"	"	Dec. 4	17,600	3.5	12.0	90.2	1.7	4	6.4		10	
" "	"	"	" 10	25,900	5.5	11.6	91.9	2.8	19	6.1		11	
Nine Mile Run upper edge Of Wilkinsburg, Pa.	MoNi	10	Sept. 6	**	17.0	8.0	82.4	1.4	1,100	7.4		135	
" "	"	"	Oct. 28	1	12.0	7.6	69.7	2.0	230	7.7		125	
" "	"	"	Nov. 28	2	6.5	10.6	86.0	1.5	240	7.5			
Nine Mile Run 4 mile bel. Wilkinsburg, Pa.	MoNi	6.5	Sept. 6	1	17.0	6.0	61.7	2.7 2.1*	4	9.6	5	97	176
" "	"	"	Oct. 28	1	11.0	4.4	43.0	7.8 8.4*	15	9.6	15	58	178
" "	"	"	Nov. 28	2	9.5	7.5	65.8	7.2 7.0*	1,100	9.4		57	
Monongahela River at mouth Pittsburgh, Pa.	Mo	0.05	Sept. 16	1,650	20.0	4.6	49.9	1.0 0.8*	43	5.5	55		137
" "	"	"	" 25	2,620	24.0	1.3	15.7	2.1 3.3*	11	3.8	6		
" "	"	"	Oct. 4	3,090	15.5	5.2	55.8	1.4 1.4*	4	3.7	14		
" "	"	"	" 9	2,840	19.5	3.8	41.3	1.6 1.7*	240	4.4	12		143
" "	"	"	" 18	2,450	18.5	3.6	38.6	2.2	23	3.9	12		14
" "	"	"	" 23	2,450	17.0	3.9	39.8	3.1 1.8*	4	3.9	4		94
" "	"	"	Nov. 1	12,400	15.0	7.9	77.9	2.9 1.8*	4	3.5	4		142
" "	"	"	" 6	11,130	12.5	10.1	93.9	1.3	9	6.6	4	5	76
" "	"	"	" 13	4,800	12.0	7.7	71.0	2.9 2.6*	46	4.3	18		100
" "	"	"	" 27	29,500	7.0	9.6	79.0	3.0	46	6.1	16	8	103
" "	"	"	Dec. 4	17,600	4.0	12.2	92.8	2.4	9	6.3	4	10	68
" "	"	"	" 10	25,900	4.0	11.3	86.1	1.8	2	6.3	5	18	82

* Seeded and neutralized

** Less than one

Table Mo-7A Monongahela River Basin - Laboratory Data - Acid Stream Results

Stream	Sampling Point	Month 1940	No. Samples	pH	ACIDITY P.P.M. Methyl Red	ACIDITY P.P.M. Phenolphthalein Hot	ACIDITY P.P.M. Phenolphthalein Cold	IRON P.P.M. Ferrous	IRON P.P.M. Total
Brown Creek	Mouth-Two Lick, W.Va. Mile 166	June	2	2.9	252	406	324	6.7	75
		July	1	3.2	-	-	164	15.0	50
West Fork R.	Abv. Clarksburg, W.Va. Mile 160	May	3	6.2	-	-	11	-	-
		June	3	6.7	-	-	6	-	-
		July	1	6.5	-	-	2	-	-
Elk Creek	Abv. Nutter Fort, W.Va. Mile 167	May	3	6.8			17		2 **
		June	3	6.9			4		
		July	1	6.4			2		
Anmore Creek	Bel. Anmore, W.Va. Mile 165	May	1	3.2	60	122	108		14
		June	4	4.1	106 +	151 +	107		18
		July	1	6.3	-	-	2		3
Elk Creek	W.Pike St.Br., Clarksburg, W.Va.-Mile 159	July	1	4.6	18	56	37		4.0
	Mouth, Clarksburg, W.Va. Mile 158	May	3	6.2	-	-	15		3.0**
		June	3	6.4		-	10.7		3.6*
		July	2	5.9	-	35	14.5		2.8
West Fork R.	Adamston Br., Clarksburg W.Va. - Mile 158	May	3	6.3	-	-	12		4.0**
		June	3	6.7	-	-	6.4		
		July	1	6.0	-	-	2.0		4.0
Limestone Run	Bel. Milk Plant, Clarksburg, W.Va. - Mile 157	May	1	4.4	9	72	32		15
		June	4	5.0	17*	83**	43	0.6**	22
		July	1	5.6			12		12
West Fork River	Perry Mines, W.Va. Mile 155	May	3	6.3			15		
		June	3	6.6			7		5.6**
		July	1	6.1			2		
	Abv. Zeising, W.Va. Mile 150	May	3	5.7		10**	19		3.5**
		June	3	6.4			8		3.8
		July	2	5.2	17**	41**	15		3.7
Simpson Creek	Abv. Bridgeport, W.Va. Mile 162	May	1	2.9	182	305	252		15
		June	4	3.0	302	340	312	.47*	44
		July	1	3.1	38	48	44		35
	Bel. Bridgeport, W.Va. Mile 156	May	1	3.1	110	178	144		20
		June	4	3.2	148	226	202		22
		July	1	3.4	44	52	48		40
Ten Mile Creek	Bel. Salem, W.Va. Mile 168.5	May	1	7.1			14		
		June	4	6.9			12		1.6**
		July	1	6.4			2		
	Bel. East Salem, W.Va. Mile 167.5	May	1	7.0			8		
		June	4	6.8			9.5		1.4**
		July	1	6.4			2		
	Abv. Lumberport, W.Va. Mile 148	May	1	5.8		7	6		
		June	4	6.4			6.2		7.0**
		July	1	6.1			6.0		
	Mouth, Lumberport, W.Va. Mile 147	May	1	4.6		8	14		0.5
		June	4	5.7	6**	16**	8.5		3.0+
		July	1	5.6			6		1.4
West Fork River Mile 128.1	Bel. Ten Mile Creek Mile 145	June	4	3.9	42	105+	68	12	
		July	1	4.4	10		16		
	Bel. Shinnston, W.Va. Mile 143	May	1	3.5	17	40	32		6
		June	4	3.8	41	82	66		11
		July	1	4.6	8		19		8
	Abv. Worthington, W.Va. Mile 138	May	1	5.7		30	16		
		June	2	3.6	26	54	42		7
	Bel. Monongah, W.Va. Mile 132	May	2	4.8	30**	44	32		
		June	3	3.5	32	58*	44		7.5*
	Mouth, Fairmont, W.Va. Mile 128	May	2	4.9		20**	16**		
		June	3	3.9	25	46	39		1.4*
Grassy Run (Tygart River)	Mouth, Norton, W.Va. Mile 202	July	1	2.5			1318	3.2	800
Three Forks Creek	Grafton, W.Va.-Mi.149.5	June	2	5.7		4**	4.5		0.67
Monongahela River	Hwy. Br. in Fairmont, W.Va.-Mile 126.7	May	2	4.7	-	33	25		
		June	3	4.6	18**	21	16		
Buffalo Creek Mile 125.0	Abv. Mannington, W.Va. Mile 145	May	1	6.6	-	-	8		0.2
		June	4	6.8	-	-	4.5		
		July	1	5.9	-	-	2		
	Bel. Mannington, W.Va. Mile 140.7	May	1	6.4	-	-	4		
		June	4	6.8	-	-	5		0.4**
		July	1	5.8	-	-	2		
	Mouth, Fairmont, W.Va. Mile 127	May	2	5.8	-	22**	9		
		June	3	6.4	-	24**	7.3		

Table Mo-7A Monongahela River Basin (Continued)

Stream	Sampling Point	Month 1940	No. Samples	pH	ACIDITY P.P.M.			IRON P.P.M.	
					Methyl Red	Phenolphthalein Hot	Phenolphthalein Cold	Ferrous	Total
Monongahela River	R.R.Bridge Bel. Fairmont,W.Va.-Mile 124.2	May	2	6.6**	-	18	12		
		June	3	4.5	14**	20	16		1.6*
	Lock and Dam #11,Morgantown,W.Va.-Mile 104.1	May	2	4.0	60**	53	44		
		June	4	4.8	9*	19	12		1.5*
Deckers Creek Mile 101.0	Abv. Sabraton,W.Va. Mile 104	June	4	4.6	9+	21	13		0.2**
	Bel. Shirt Fac.,Morgantown,W.Va.-Mile 103	May	2	4.6	12**	23	16		
		June	4	4.6	13*	26+	20		0.2**
	Mouth, Morgantown,W.Va. Mile 101	May	2	4.7	6**	18	11		
		June	4	4.9	6*	21	14		0.2**
Monongahela River	Br. in Morgantown,W.Va. Mile 100.9	May	2	4.0	52**	46	39		
		June	4	4.9	7*	15	8		1.6**
	Star City (Ferry) W.Va. Mile 97.7	May	2	4.4		47	40		
		June	4	4.4	7*	26+	17		1.8*
	Lock & Dam #8, Pt. Marion,Pa.-Mile 90.6	May	1	5.0			12		
		June	2	4.5			16		1.4
		Aug.	2	3.3	37	53	46		1.9
		Sept.	4	3.4	35	44	43		1.8
		Oct.	5	3.8	18	21	20		1.3
		Nov.	4	4.3	7	15	14		1.7+
		Dec.	2	4.1	7**	22**	18		2.2
Blackwater R. (Cheat R.Basin) Mile 170.8	Davis, W.Va.-Mile 183	June	2	6.7					0.79
		July	1	6.7					0.66
	Abv. Thomas, W.Va. Mile 181	June	2	5.6		10	8		1.22
		July	1	5.5			9		
	Bel. Thomas, W.Va. Mile 180	June	1	5.5	12	34	26		3.8
		July	1	5.3			13		5.4
	Mouth, Hendricks, W.Va. Mile 171	June	2	4.8	11**	22	17		3.9
		July	1	4.6					1.7
Green Run Creek	Between Kingwood & Albright,W.Va.-Mile 118.5	June	2	3.6	34	52	45		4.0
		July	1	3.3			88	0.30	
Cheat River Mile 89.1	Ices Ferry, W.Va. Mile 100.5	May	1	6.5			6		
		June	2	6.3			4		
	Mouth, Pt. Marion, Pa. Mile 89.1	May	1	6.4			8		
		June	2	5.0	16**	32**	13		1.7
Monongahela River	Lock & Dam #7 Mile 84.8	May	1	5.7			16		
		June	2	4.1	20**	35**	19		4.0**
		Aug.	2	3.3	34	49	43		2.5
		Sept.	4	3.3	25	35	31		1.4
		Oct.	5	3.8	11	21	16		1.9
		Nov.	2	4.5	4	11	9		1.6
		Dec.	2	4.2	6**	20**	18		2.2
Muddy Creek	Abv. Fairchance, Pa. Mile 96.0	Aug.	1	3.9	26	48	40		1.4
		Oct.	1	5.5	12	26	15		2.3
		Nov.	1	5.3			12		4.5
Georges Creek	Bel. Smithfield, Pa. Mile 91.5	Aug.	1	3.6	45	75	60		0.6
		Oct.	1	4.2	20	67	37		1.5
		Dec.	1	5.6			16		4.4
Jacobs Creek	Greensboro, Pa. Mile 84	Oct.	2	5.5	60**	75	66	8.0**	22
Cats Creek	Bel. Masontown, Pa. Mile 81	Aug.	1	2.5	1979	296	2510	108	397
		Oct.	1	2.5	1970	2734	2374	127	367
		Dec.	1	2.9			2064	90	345
Monongahela River	Lock & Dam #6 Mile 68.3	Aug.	2	3.3	45	60	54		2.3
		Sept.	4	3.4	34	45	49		1.5
		Oct.	5	3.6	20	30	27		1.2
		Nov.	3	4.3	10	20	19		1.7
		Dec.	2	4.9	2**	15**	14		1.1
	Lock & Dam #5 Mile 56.5	Aug.	2	3.6	22	33	30		1.2
		Sept.	4	4.2	22+	34+	32		0.9
		Oct.	5	3.9	14	23	19		1.4
		Nov.	2	4.5	7	21	15		2.2
		Dec.	1	5.7	3	16	12		1.5
Dunlop Creek Mile 56	Bel. New Salem, Pa. Mile 67	Oct.	1	7.0			37	12	24.6
	Bel. Republic, Pa. Mile 61	Oct.	1	6.2	2	172	237	78.3	103
		Dec.	1	6.9			90	12	56
Redstone Creek Mile 55	Abv. Uniontown,Pa. Mile 74	Aug.	1	2.9	553	1016	965	162	425
		Oct.	1	3.2	1076	1682	1416	155	361
		Nov.	1	3.3			1180	286	428
	Bel. Uniontown, Pa. Mile 73	Aug.	1	3.1	308	759	660	159	310
		Oct.	1	3.1	334	786	650	136	175
		Nov.	1	3.5			640	164	258
Monongahela River	Lock & Dam #4 Mile 41.5	Aug.	2	3.3	43	69	55		2.4
		Sept.	3	3.8	20	34	27		1.9
		Oct.	5	3.6	22	35	29		1.5
		Nov.	3	4.3	8	18	20		5.1
		Dec.	2	5.1		11**	11		4

Table Mo-7A Monongahela River Basin (Continued)

Stream	Sampling Point	Month 1940	No. Samples	pH	ACIDITY P.P.M.			IRON P.P.M.	
					Methyl Red	Phenolphthalein Hot	Phenolphthalein Cold	Ferrous	Total
N.Fk. Pigeon Creek	Mouth, Bentleyville, Pa. Mile 40	Sept.	1	4.6	65	435	467	158	159
Monongahela River	Lock & Dam #3 Mile 23.8	Sept.	1	3.7	19	34	28		1.4
		Oct.	4	3.6	19	30	27		1.9
		Nov.	3	4.5	13	23	18		5.4
		Dec.	1	5.5			18	1.8	4.8
	Abv. Mouth Youghiogheny Mile 16	Aug.	2	3.8	26	55	43		3.1
		Sept.	2	4.2	7	18	27		3.4
Snowy Creek (Youghiogheny)	Corinth, W.Va. Mile 135	June	1	5.5		7	8		3.8
Youghiogheny River	Bel. Oakland, Md. Mile 128	June	2	5.3		14	13		4.3
		July	1	4.4			17		1.3
	Abv. Confluence, Pa. Mile 86	July	2	5.3		9	6		0.4
		Aug.	1	4.4			3		2.4
Casselman River	Abv. Meyersdale, Pa. Mile 116	July	2	3.9	63**	110**	103	6.7	27.3
		Aug.	1	3.1			112	6	7
	Bel. Meyersdale, Pa. Mile 113	July	2	3.3	60	91	79	5.7	26
		Aug.	1	3.1			116	2.2	9
	Abv. Garrett, Pa. Mile 111	July	2	3.2	52	80	67	0.68**	15
		Aug.	1	3.0			100		22
Buffalo Creek	Mouth, Garrett, Pa. Mile 111	July	2	3.5	20	40	29	1.9**	3.7
		Aug.	1	3.8			19		0.8
Casselman River	Bel. Garrett, Pa. Mile 109	July	2	3.4	42	68	55	0.1**	4.6
		Aug.	1	3.0			87		4.2
	Abv. Rockwood, Pa. Mile 105.5	July	2	3.4	36	65	51		3.7
		Aug.	1	2.9			121		4.4
Coxes Creek	Mouth, Rockwood, Pa. Mile 104.5	July	1	5.2			43	1.2	3.8
		Aug.	1	3.6		12	9		9
Casselman River Mile 85.5	Bel. Rockwood, Pa. Mile 104	July	2	3.8	20	43	32		5.0
		Aug.	1	2.9			119		5.4
	Mouth, Confluence, Pa. Mile 87	July	2	3.9	15	28	22		1.2
		Aug.	1	3.7			32		2.8
Youghiogheny River	Bel. Confluence, Pa. Mile 84.5	July	2	5.4		8	6		1.1
		Aug.	1	4.7			3		1.2
Dickerson Run	Upper edge, Vanderbilt, Pa. - Mile 53.5	Oct.	1	4.6	38	80	56		8.0
W.Br. Dickerson Run	Upper edge, Vanderbilt, Pa. - Mile 53.5	Dec.	1	5.6			22		4.4
Washington Run Mile 44	Bel. Star Junction, Pa. Mile 49.5	Aug.	1	4.8	3	34	30	2.8	6.6
Jacob Creek Mile 42	Bel. Scottdale, Pa. Mile 53	Sept.	1	5.4	2	20	18		4.6
Youghiogheny River	Abv. West Newton, Pa. Mile 35	Sept.	1	4.5	3	12	7		3.7
	Bel. West Newton, Pa. Mile 33	Sept.	1	4.5	4	10	10		3.3
Jacks Run	Abv. Greensburg, Pa. Mile 58	Sept.	1	2.7	4990	8720	8420	2247	2406
		Oct.	1	2.9	850	1400	1360	105	193
	Abv. Mouth Slates Creek Greensburg, Pa.-Mi.53.5	Oct.	2	3.5	1540	3710	3492	933	998
		Nov.	5	4.2	795	1966	1772	608	649
		Dec.	1	4.1	1100	2520	2900	698	700
	Bel. Mouth Slates Creek Mile 53	Sept.	2	3.6	783	1737	1659	422	476
		Oct.	1	3.3	580	1220	1010	131	166
	Abv. Youngwood, Pa. Mile 52.5	Sept.	1	6.0		143	168	56	63
	Bel. Youngwood, Pa. Mile 51	Sept.	1	6.0		151	165	55	62
Sewickley Creek Mile 33.1	Abv. Mouth Jacks Run Youngwood, Pa.-Mile 51	Sept.	2	3.5	190	385	344	56	143
Youghiogheny River Mile 15.6	Abv. Versailles, Pa. Mile 20	Sept.	1	3.8	19	37	30		6.2
	Bel. Versailles, Pa. Mile 18	Sept.	1	3.8	19	34	28		3.3
	Mouth, McKeesport, Pa. Mile 15.6	Aug.	2	3.5	35	73	55	1.8**	7
		Sept.	3	3.8	22	40	31	0.8**	3.9
		Oct.	4	3.6	45	76	66	24	6.0*
		Nov.	2	4.5	8	24	20	5.2**	16

Table Mo-7A Monongahela River Basin (Continued)

Stream	Sampling Point	Month 1940	No. Samples	pH	ACIDITY P.P.M.			IRON P.P.M.	
					Methyl Red	Phenolphthalein		Ferrous	Total
						Hot	Cold		
Brush Creek (Turtle Creek)	Abv. Irwin, Pa. Mile 25	Sept.	1	3.2	452	605	545	4.0	127
		Oct.	1	3.3	245	359	312	1.6	75
		Nov.	1	3.5	150	228	183	0.4	51
	Bel. Irwin, Pa. Mile 23	Sept.	1	3.6	246	504	457	77	121
		Oct.	1	3.4	261	488	438	72	118
		Nov.	1	3.8	150	302	300	60	82
Turtle Creek Mile 11.0	Abv. Export, Pa. Mile 28	Sept.	1	2.9	1120	1550	1560	93	182
		Oct.	1	3.1	990	1660	1249	24	374
	Bel. Export, Pa. Mile 25.5	Sept.	1	2.9	650	890	840	15	99
		Oct.	1	3.1	650	1350	839	8	175
	Abv. Trafford, Pa. Mile 18.5	Sept.	1	3.9	139	179	159		9
		Oct.	1	3.2	213	300	248		24
	Bel. Trafford, Pa. Mile 17.5	Sept.	1	3.3	98	142	135	7	12
		Oct.	1	3.5	151	235	194	5	16
	Abv. Pitcairn, Pa. Mile 16	Sept.	1	3.3	239	313	294	5.5	40
		Oct.	1	3.2	365	623	498	85	130
	Abv. Turtle Creek, Pa. Mile 14.5	Sept.	1	2.9	186	247	233	6.5	36
		Oct.	1	2.9	300	422	367	28	70
	Bel. Turtle Creek, Pa. Mile 12	Sept.	1	2.9	157	234	223	13	37
		Oct.	1	3.2	220	365	318	54	72
Monongahela River	Lock & Dam #2 Mile 11.2	Aug.	2	3.6	34	65	49		2.7
		Sept.	3	3.9	15	29	25		4.3
		Oct.	4	3.7	26	43	33	0.8**	5
		Nov.	3	4.3	13	27	21		5.6
	Mouth - Mile .05	Sept.	2	4.4	8	22	22	2.1**	4.2
		Oct.	4	4.0	18	35	30	3.5**	3.7
		Nov.	2	3.6	17	34	31.	5.8**	5.0

** One Sample
* Two Samples
* Three Samples

BEAVER RIVER BASIN

Final Report to the Ohio River Committee

Ohio River Pollution Survey

U. S. Public Health Service
Cincinnati, Ohio
1942

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BEAVER RIVER BASIN

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Fig. B-1

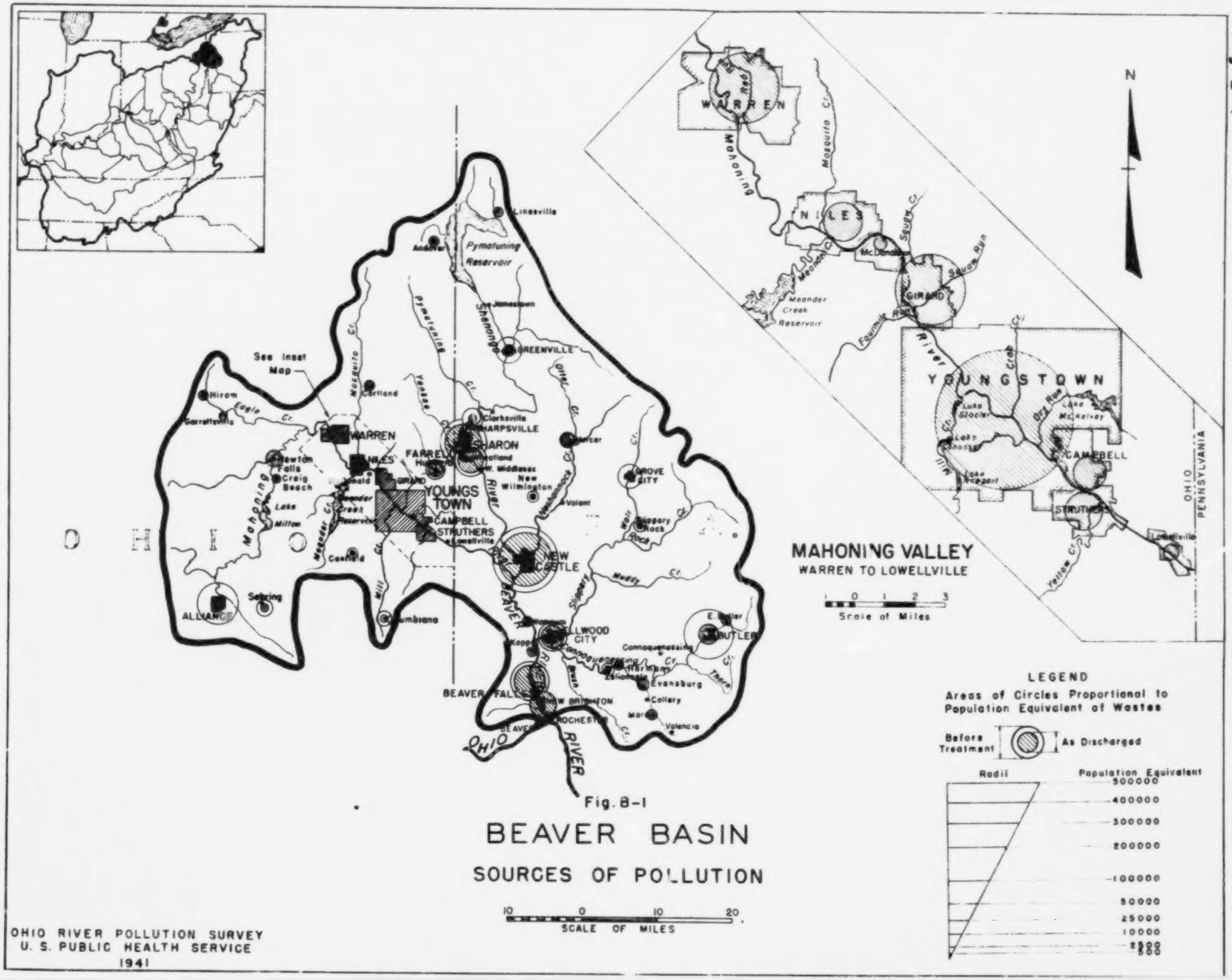

Fig. B-1

BEAVER BASIN

SOURCES OF POLLUTION

OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941

MAHONING VALLEY
WARREN TO LOWELLVILLE
Scale of Miles
0 1 2 3
N
LEGEND
Areas of Circles Proportional to Population Equivalent of Wastes
Before Treatment
As Discharged
Radii
Population Equivalent
500000
400000
300000
200000
100000
50000
25000
10000
2500
500
SCALE OF MILES
10 0 10 20
See Inset Map
OHIO
PENNSYLVANIA
WARREN
NILES
McDonald
GIRARD
YOUNGSTOWN
YOUNGS TOWN
CAMPBELL
STRUTHERS
Lowellville
Mahoning
Mosquito Cr.
Meander Cr.
Meander Creek Reservoir
Squaw Cr.
Sauna Run
Fourmile Run
Crab Cr.
Dry Run
Mill Cr.
Yellow Cr.
Lake McKelvey
Lake Glacier
Lake Cohasset
Lake Newport
River
Linesville
Andover
Pymatuning Reservoir
Jamestown
Shenango
Pymatuning
Yankee
GREENVILLE
Otter Cr.
Clarksville
SHARPSVILLE
SHARON
FARRELL
Hubbard
Wheatland
W. Middlesex
New Wilmington
Volant
Mercer
GROVE CITY
Wolf Cr.
Slippery Rock
Slippery Rock Cr.
Muddy Cr.
NEW CASTLE
BEAVER
ELLWOOD CITY
Koppel
E. Butler
BUTLER
Connoquenessing Cr.
Evansburg
Callery
Mars
Valencia
Brush
BEAVER FALLS
NEW BRIGHTON
ROCHESTER
BEAVER
OHIO
RIVER
Hiram
Garrettsville
Eagle Cr.
Cortland
Newton Falls
Craig Beach
Lake Milton
Canfield
Columbiana
Sebring
ALLIANCE
Mill Cr.

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BEAVER RIVER BASIN

Syllabus and Conclusions

Syllabus

The Beaver River drains 3,145 square miles in Ohio and Pennsylvania. The population of the area is 728,000, roughly 230 per square mile, of which almost two-thirds are in urban communities. The largest city, Youngstown, Ohio (167,720) is the center of the third largest steel producing area in the country. The streams and reservoirs of the basin are intensively used as sources of municipal and industrial water supply and for recreation. About 42 percent of the sewage is treated and more than 95 percent of the untreated wastes enter the Mahoning River in the Youngstown district (Warren to Lowellville). Except for the Beaver and sections of the Mahoning and Shenango Rivers, the streams of the basin are relatively clean. Abatement of pollution in the Youngstown district can be most economically effected by a combination of waste treatment and stream flow regulation. Reservoir sites have been investigated by the U. S. Engineer Department with a view toward providing needed additional flow for both pollution abatement and industrial water supply. Further industrial development in the Youhgstown district should be predicated on obtaining additional water from sources not now considered.

Conclusions

(1) Eighteen of the 50 public water supplies in the basin are from surface sources. Twelve of these, serving 430,000 people are from streams or reservoirs subject to pollution.

(2) Sewage from 515,000 people, industrial wastes equivalent to sewage from an additional 165,000 people and about 32 tons of acid per day enter the streams of the basin. Thirty-six plants treat about 42 percent of the sewage and several of the industrial plants have installed waste treatment facilities.

(3) Laboratory data show the Mahoning River, particularly in the Youngstown district, to be grossly polluted. The Beaver River is moderately polluted and the Shenango is in fairly satisfactory sanitary condition. Smaller tributary streams are relatively clean.

(4) The major pollution problem of the basin is in the Youngstown district. More than 95 percent of the untreated wastes in the entire basin enter the Mahoning River in the 25 miles from Warren to Lowellville.

(5) Industrial water use in this stretch, principally for cooling purposes, is about 20 times the minimum stream flow. The resulting high water temperatures intensity the effects of pollution and increase industrial costs.

(6) Chemical treatment of sewage plus low-flow control by reservoirs offers the most economical method of organic pollution abatement in the Youngstown district. Low-flow augmentation alone, or without a parallel program of sewage treatment, will actually have a detrimental effect on the Beaver River because of decreased time of flow. Local conditions and river temperature will, of course, be improved.

(7) Primary treatment, the minimum that can be considered satisfactory under the most favorable circumstances, is indicated at four other communities where stream flows are adequate including Newton Falls, Ohio and New Brighton, Pennsylvania. The latter city, being near the mouth, is primarily an Ohio River problem. Secondary treatment is indicated at five small towns in Ohio located on streams subject to very low flows. Additions or improvements to treatment facilities are needed at eight places and progress is being made toward completion of the improvements in most of these cases.

(8) Industrial treatment is needed principally to reduce phenol discharges at by-product coke plants and to reduce the acid load on the stream. This can be accomplished by methods now in use at other plants.

(9) A summary of cost estimates of remedial measures from Table B-1 follows:

Treatment	Capital Cost	Annual Charges
Existing	$4,760,000	$ 415,000
Suggested additional	6,000,000	865,000

Estimated additional costs, over existing charges, of programs involving uniform treatment throughout the basin are:

Primary, all places	5,830,000	845,000
Secondary, all places	10,680,000	1,265,000

Table B-1 Beaver River Basin - Estimated Cost of Existing and Suggested Minimum Corrective Measures for Sewage and Industrial Wastes, with Comparative Costs for Primary and Secondary Treatment.

	Number of Plants		Population Connected to Sewers	Capital Investment (Dollars)	Annual Charges (Dollars)		
	Prim.	Sec.			Amort. & Interest	Operation & Main.	Total
Existing Sewage Treatment	17	18	218,400	4,760,000	300,000	115,000	415,000
Suggested Minimum Correction							
Sewage Treatment Plants	14	5	297,100	2,970,000	210,000	190,000	400,000
Required Interceptors	-		-	1,990,000	95,000	-	95,000
Independent Industrial Waste Correction	-		-	1,040,000	135,000	235,000	370,000
Total				6,000,000	440,000	425,000	865,000
Comparative Cost							
Primary Treatment All Waste				5,830,000	425,000	420,000	845,000
Secondary Treatment All Waste				10,680,000	710,000	555,000	1,265,000
As Suggested				6,000,000	440,000	425,000	865,000

Description

The Beaver River is formed by the confluence of the Mahoning and Shenango Rivers near New Castle, Pennsylvania, and flows southward for 20 miles to its junction with the Ohio River 25 miles below Pittsburgh. It drains an area of 3,145 square miles, of which 1,360 are in Ohio and 1,785 in Pennsylvania. Much of the land is flat, particularly in the northern half of the basin but the southeastern portion is quite hilly. The principal tributaries of the Beaver River are:

Tributary	Distance above Mouth of Beaver	Drainage Area Square Miles
Connoquenessing Cr.	12.4	830
Mahoning River	20.7	1,100
Shenango River	20.7	1,080

The basin is densely populated (230 per sq.mi.) and about two-thirds of the population is in the 22 urban communities. The populations of some of the larger cities and of the basin as a whole are shown below.

Principal Cities	Population			
	1910	1920	1930	1940
Youngstown, Ohio	79,066	132,358	169,912	167,720
New Castle, Pa.	36,280	44,938	48,674	47,638
Warren, Ohio	11,081	27,050	41,062	42,837
Sharon, Pa.	15,270	21,747	25,908	25,622
Butler, Pa.	20,728	23,778	23,568	24,477
Alliance, Ohio	15,083	21,603	23,047	22,405
Beaver Falls, Pa.	12,191	12,802	17,147	17,098
Niles, Ohio	8,361	13,080	16,314	16,273
Farrell, Pa.	10,190	15,586	14,359	13,899
Campbell, Ohio	4,972	11,237	14,673	13,785
Ellwood City, Pa.	3,902	8,958	12,323	12,329
Struthers, Ohio	3,370	5,847	11,249	11,739
Entire Basin				
Rural	178,013	189,950	220,208	251,101
Urban	251,086	389,343	480,079	477,267
Total	429,099	589,293	700,287	728,368

Almost all of the cities experienced a period of rapid population increase during the first 30 years of this century which saw the region develop into a major center of steel production.

This period of rapid growth ended in 1930 and most of the cities lost population during the next 10 years. The rural population continued to increase however.

Water Uses - None of the streams are navigable at present except for the lower mile of the Beaver which is affected by backwater from the Ohio River. A proposal to connect the Ohio River and Lake Erie by a canal using the Beaver, Mahoning and Grand Rivers has been studied by the U. S. Engineer Department and considered by the Congress a number of times but has not been authorized.

There are no hydroelectric power storage reservoirs and no sites where the development of hydroelectric energy appears to be economically feasible at the present time. No flood-control reservoirs, as such, have been built but a number of reservoirs built for other purposes have undoubtedly aided in reducing flood heights. The largest of these are the Pymatuning Reservoir, Lake Milton and Meander Reservoir. Pymatuning Reservoir on the upper Shenango has a capacity of 192,000 acre-feet and a surface area of 17,880 acres. It was built by Pennsylvania primarily to regulate stream flow to insure an adequate supply of water for downstream cities and industries. Lake Milton on the Mahoning River above Warren was built by the city of Youngstown and private interests to increase the flow of the stream during dry weather. It has been useful in this respect but its small capacity of 28,100 acre-feet has limited its utility. Both Pymatuning Reservoir and Lake Milton are used extensively for recreation. Meander Reservoir on Meander Creek was built by the Mahoning Valley Sanitary District to provide public water supplies for Youngstown and Niles. Its capacity is 32,400 acre-feet. Fifteen other reservoirs with capacities of from 100 to 4,600 acre-feet have been built for water supply, recreation or flow regulation.

The Berlin Reservoir on the Mahoning above Lake Milton is now (1942) under construction by the U. S. Engineer Department in connection with the authorized program for Ohio River flood control. In addition to controlling floods, the reservoir will provide storage for low-flow control.

Presentation of Field Data

Figure B-1 shows the location and magnitude of the more important sources of pollution in the basin. Figure B-2 shows similar data and, in addition, the location of public water supply intakes from polluted streams and selected laboratory data on coliform organisms, dissolved oxygen and B.O.D.

Public Water Supplies - Fifty public water supplies in the basin served 554,100 people. Eighteen supplies serving almost 500,000 people are from surface sources and twelve of these are from streams or reservoirs subject to sewage pollution. Table B-2 shows data on the surface water supplies of the basin. The supplies from the Beaver River are the most seriously polluted and the most complete treatment of these supplies often fails to produce a palatable water.

Sewerage - Sewage from 515,700 people is discharged to the streams of the Beaver Basin. About 42 percent of this waste is treated. In the Pennsylvania section of the basin practically all sewage is treated, the principal exception, New Brighton, discharging only about one mile from the mouth and being primarily an Ohio River problem. On the other hand, in the Ohio section of the basin, 285,800 out of 321,500 discharge sewage without treatment. Almost all of this waste enters the Mahoning River in the 25-mile stretch from Warren to Lowellville.

There are 35 sewage treatment plants in the basin, 17 of which provide primary treatment and 18 of which provide secondary treatment. Twenty-six of the plants are in Pennsylvania and only 9 are in Ohio.

Industrial Wastes - Table B-4 summarizes data on the sources of industrial wastes by type of industry and method of disposal. The population equivalent of these wastes does not reflect the magnitude of the industrial waste problem since the steel mill wastes have no significant B.O.D. The disposal of waste pickle liquor from steel mills in the basin is summarized as follows:

Free Acid* in Waste Pickle Liquor - Pounds per Day

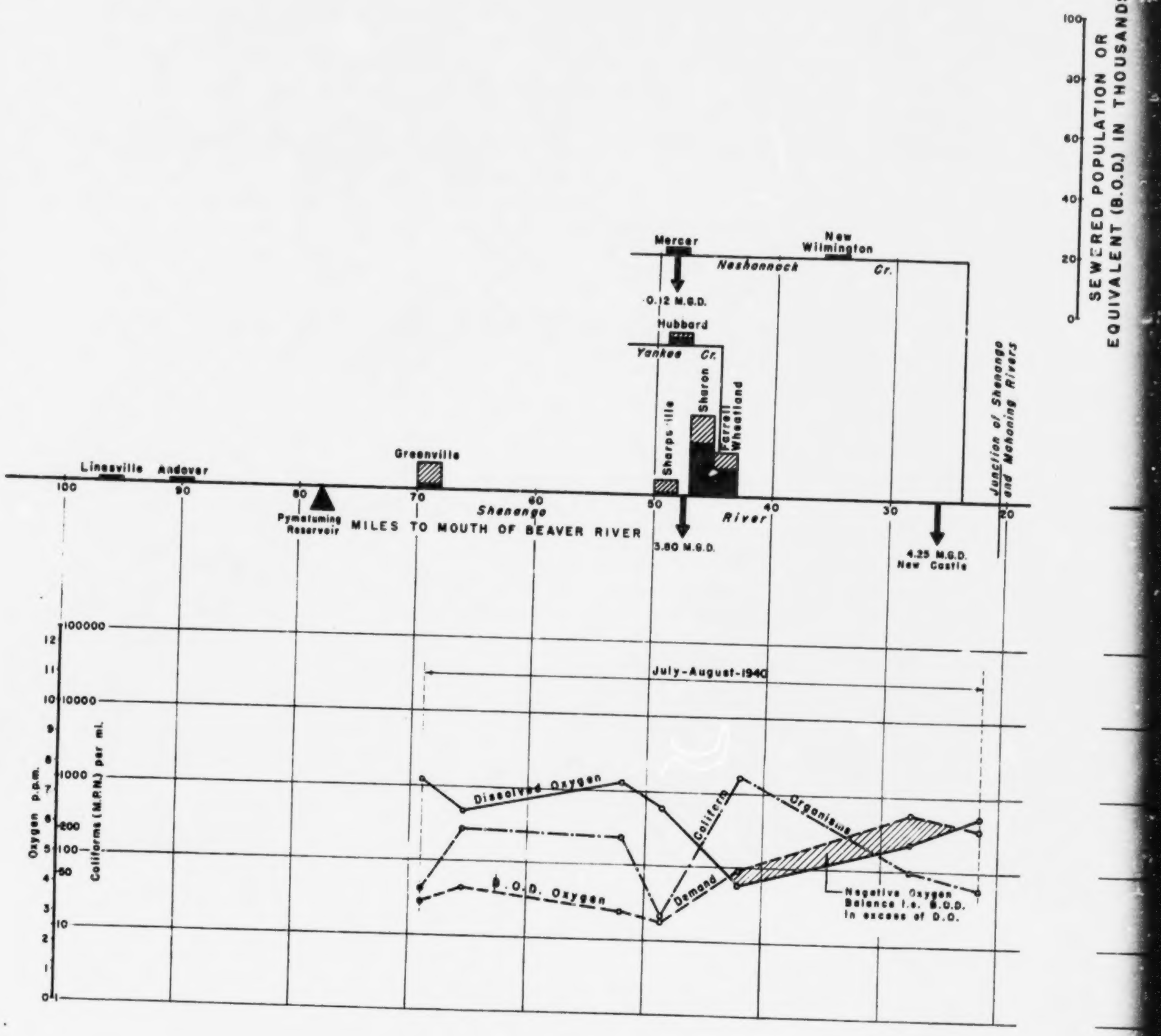
State	Total	Neutralized	Discharged Without Neutralization
Ohio	63,000	3,000	60,000
Pennsylvania	18,600	14,800	3,800
Total	81,600	17,800	63,800

* Exclusive of $FeSO_4$ which exerts some acid effect.

Table B-2 Beaver River Basin - Surface Water Supplies

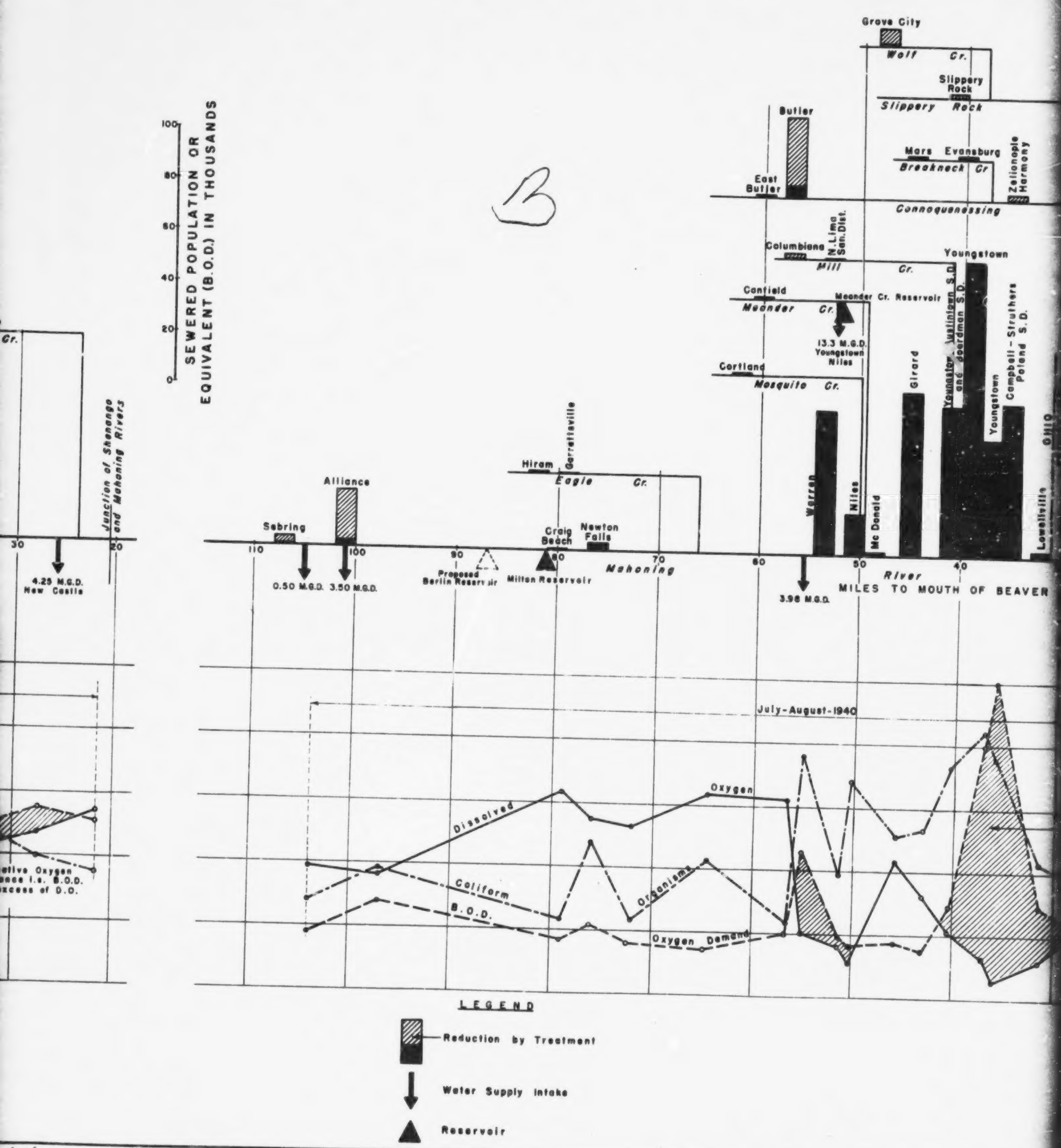
Municipality	State	Source	Mile (1)	Treatment (2)	Population Served	Cons. M.G.D.
		Supplies Below Community Sewer Outfalls				
New Brighton	Pa.	Beaver River	3.6	FD	22,500	1.75
Beaver Falls	"	" "	5.3	FD	25,000	2.30
West Pittsburgh	"	" "	18.0	FD	400	0.07
New Castle	"	Shenango River	25.8	FD	58,000	4.25
Sharon	"	" "	47.5	FD	50,000	3.80
Warren	Ohio	Mahoning River	56.5	LD	42,800	3.98
Alliance	"	" "	101	FD	22,400	3.50
Sebring	"	" "	105	FD	3,900	0.50
Ellwood City	Pa.	Slippery Rock Cr.	21.5	FD	12,000	2.00
Mercer	"	Otter Creek	48.5	FD	2,200	0.12
Youngstown	Ohio	Meander Cr. Res.	52.5	LD	175,000	10.7
Niles	"	" " "	52.5	LD	16,200	2.60
		Other Surface Supplies				
Zelionople	Pa.	Impounded-Scholar Run	-	FD	2,000	0.18
Evansburg	"	Wells-Likens Run	-	F	1,600	0.12
Butler	"	Connoquenessing Creek	61	FD	30,000	3.30
Greenville	"	Impounded-Trib. of L. Shenango	-	FD	8,500	0.50
Struthers	Ohio	Impounded-Yellow Creek	-	FD	13,000	0.65
Campbell	"	" " "	-	FD	13,700	0.56
Total - Below Sewer Outfalls					430,400	35.57
Other					68,800	5.31
Total - Surface Water Supplies					499,200	40.88

(1) Miles above mouth of Beaver River.
(2) L - Lime-soda softened; D - Chlorinated; F - Coagulated, settled, filtered.

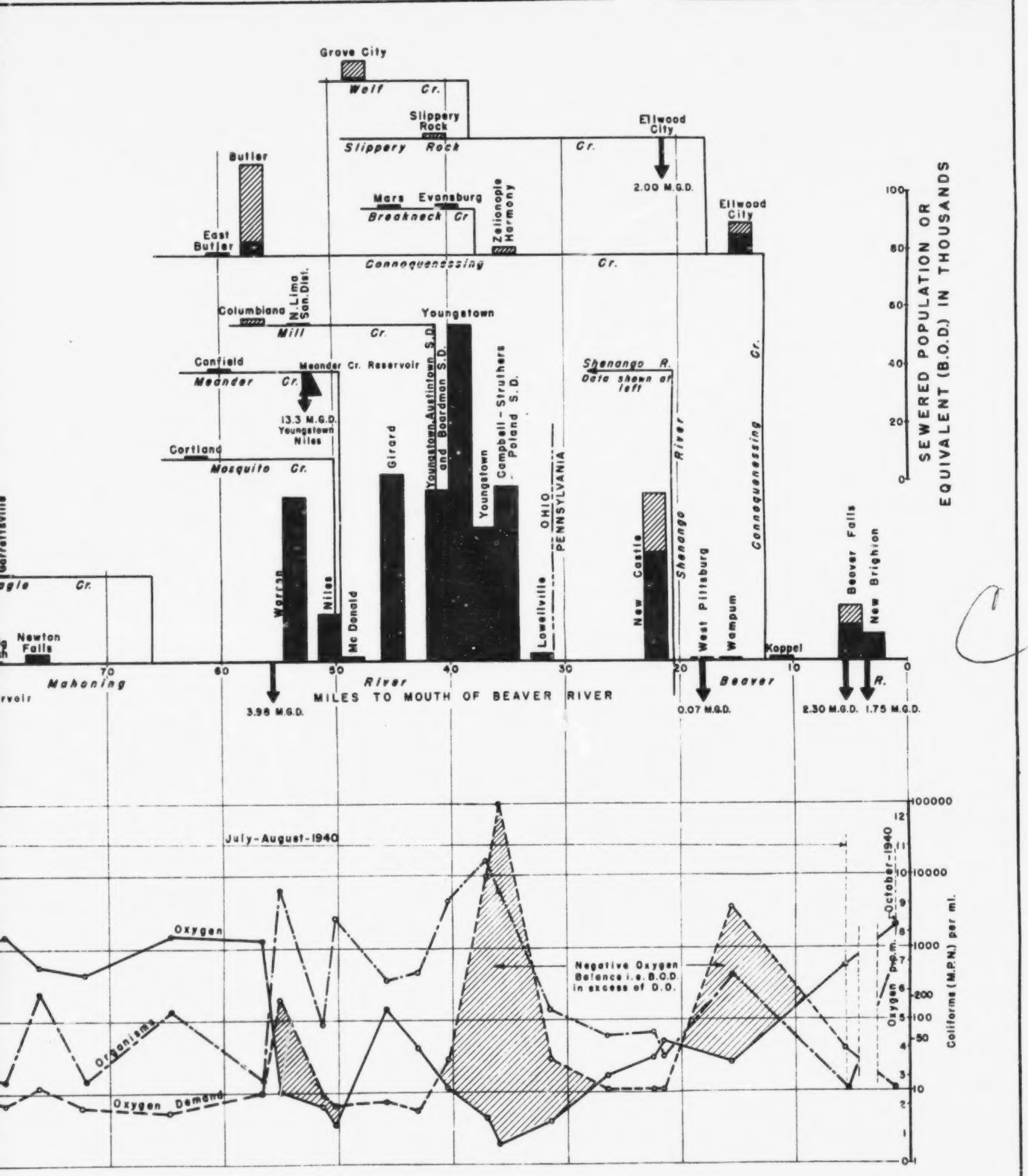

SEWERED POPULATION OR EQUIVALENT (B.O.D.) IN THOUSANDS
100
80
60
40
20
0
Linesville
Andover
Greenville
Mercer
New Wilmington
Neshannock Cr.
0.12 M.G.D.
Hubbard
Yankee Cr.
Sharpsville
Sharon
Farrell
Wheatland
Junction of Shenango and Mahoning Rivers
100
90
80
70
60
50
40
30
20
Pymatuning Reservoir
Shenango River
MILES TO MOUTH OF BEAVER RIVER
3.80 M.G.D.
4.25 M.G.D. New Castle
Oxygen p.p.m.
Coliforms (M.P.N.) per ml.
12
11
10
9
8
7
6
5
4
3
2
1
0
100000
10000
1000
200
100
50
10
1
July-August-1940
Dissolved Oxygen
Coliform Organisms
B.O.D. Oxygen Demand
Negative Oxygen Balance i.e. B.O.D. in excess of D.O.

A

306 b


SEWERED POPULATION OR EQUIVALENT (B.O.D.) IN THOUSANDS
0
20
40
60
80
100
B
Grove City
Wolf Cr.
Slippery Rock
Slippery Rock
Butler
East Butler
Mars
Evansburg
Breakneck Cr
Zelionople Harmony
Connoquenessing
Columbiana
N. Lima San. Dist.
Mill Cr.
Youngstown
Canfield
Meander Cr.
Meander Cr. Reservoir
13.3 M.G.D. Youngstown Niles
Cortland
Mosquito Cr.
Girard
Youngstown Austintown S.D. and Boardman S.D.
Youngstown
Campbell-Struthers Poland S.D.
Warren
Niles
Mc Donald
Lowellville
OHIO
Hiram
Garrettsville
Eagle Cr.
Alliance
Sebring
Craig Beach
Newton Falls
Mahoning River
MILES TO MOUTH OF BEAVER
110
100
90
80
70
60
50
40
30
20
0.50 M.G.D.
3.50 M.G.D.
Proposed Berlin Reservoir
Milton Reservoir
3.96 M.G.D.
Cr.
4.25 M.G.D. New Castle
Junction of Shenango and Mahoning Rivers
July-August-1940
Dissolved Oxygen
Coliform Organisms
B.O.D.
Oxygen Demand
…tive Oxygen …ance i.e. B.O.D. …xcess of D.O.
LEGEND
▨ Reduction by Treatment
Water Supply Intake
Reservoir

96 ℓ



C

FIGURE-B-2

BEAVER RIVER

SOURCES OF POLLUTION
AND
SELECTED LABORATORY DATA

OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941

Table B-3 Beaver River Basin - Source of Significant Pollution Including Industrial Wastes, Expressed as Sewered Population Equivalent (B.O.D.)

Municipality	State	Receiving Stream	Mile (1)	Population Connected to Sewers	Treatment (2)	Sewered Population Equivalent (B.O.D.)	
						Untreated	Discharged
New Brighton	Pa.	Beaver River	3	9,000	None	9,000	9,000
Beaver Falls	"	" "	4	19,000	Pri.	19,000	12,400
Farrell	"	Shenango River	44	14,000	"	14,000	9,100
Sharon	"	" "	45	27,000	"	27,000	17,500
Sharpsville	"	" "	49	5,000	Sec.	5,000	700
Greenville	"	" "	69	8,500	Pri.	8,700	5,600
New Castle	"	Mahoning River	22	50,000	" D.	57,500	37,500
Struthers	Ohio	" "	34	11,700	None	11,700	11,700
Poland C.S.D. (3)	"	" "	35	4,000	"	4,000	4,000
Campbell	"	" "	36	13,700	"	13,700	13,700
Youngstown	"	" "	40	178,700	"	260,500	260,500
Girard	"	" "	44	9,700	"	64,700	64,700
Niles	"	" "	50	16,200	"	16,200	16,200
Warren	"	" "	56	42,800	"	56,800	56,800
Newton Falls	"	" "	76	3,100	"	3,100	3,100
Alliance	"	" "	101	22,000	Sec.	22,000	2,200
Ellwood City	Pa.	Connoquenessing Cr.	14	10,500	Pri.D.	10,500	6,800
Butler	"	" " "	57	27,000	Sec.	31,100	4,700
Grove City	"	Wolf Creek	41	7,000	"	7,000	1,000
Mercer	"	Neshannock Creek	48	2,500	Pri.	2,500	1,600
Hubbard	Ohio	Little Yankee Creek	48	4,100	"	4,100	2,700
Sebring	"	Fish Creek	107	3,500	Sec.	3,500	500
33 smaller sources				26,700	(4)	28,500	16,400
Total - Ohio				321,500		472,800	444,300
Pennsylvania				194,200		207,300	114,100
Total				515,700		680,100	558,400

(1) Miles above mouth of Beaver River.
(2) Pri.-Primary; Sec.-Secondary; D-Chlorination
(3) County Sewer District
(4) Ten primary and 11 secondary treatment plants.

As in the case of domestic sewage, the bulk of the organic industrial wastes and of the acid is discharged to the Mahoning River in the Youngstown area.

Industrial Water Supply - About 780 m.g.d. of water are used by the various industries in the basin and about 630 m.g.d. of this are drawn from the Mahoning River in the 25-mile stretch from Warren to Lowellville. Relatively small amounts of this industrial water supply are used as boiler feed and in manufacturing processes. Almost all of it is used as cooling water and is returned to the streams unchanged except for its increased temperature. Since this water demand exceeds even the average flow of the stream, the water must be reused and the temperature increases tend to pyramid. During periods of low stream flow the water temperature below Youngstown has risen often to over 110°F.

Table B-[illegible] Beaver River Basin - Summary of Industrial Wastes not Discharged to Municipal Treatment Plants, with Total of Entire Industrial Waste Load in the Basin.

Industry	Number of Plants	Industrial Waste Disposal		At Least Minor Corrective Measures Taken	Estimated Sewered Population Equivalent (B.O.D.)
		Munic. Sewers	Private Outlets		
Brewing	2	1	1	2	5,300
By-product coke	4	-	4	3	80,400
Chemical	4	1	3	2	-
Meat	2	2	-	2	7,200
Milk	3	1	2	2	3,400
Steel Mill	39	1	38	24	-
Miscellaneous	22	3	19	10	56,300
Waste Unconnected Munic. Treatment	76	9	67	45	152,600
Waste Connected to Municipal Treatment					11,800
Total Industrial Waste in Basin					164,400

Presentation of Laboratory Data

Table B-7 summarizes laboratory data on the Beaver River. Table B-5 shows selected data at some of the more important points. Except for the observations at the mouth of the Beaver, all the results were obtained by a mobile laboratory during June, July and August, 1940. The mouth of the Beaver was sampled in October, November and December, 1940 by the laboratory boat Kiski.

In cooperation with the State Health Departments of Ohio and Pennsylvania, taste and odor problems in the Beaver Basin were studied in November and December, 1940 and January, 1941. Laboratory facilities at Mineral Ridge, Ohio were made available through the courtesy of the Mahoning Valley Sanitary District. Results of this work are summarized in Table B-5A.

Figures B-3, B-4 and B-5 show graphically the coliform, dissolved oxygen and B.O.D. results. These results represent the most unfavorable monthly averages.

The laboratory data indicate clearly the grossly polluted condition of the Mahoning River in its lower 25 miles. The Beaver River is also polluted and the Shenango is in somewhat better sanitary condition. Considering the high degree of industrial development, the large urban population, and the low stream flows, the situation might well be worse.

With the exception of the small community of Linesville, (which has passed a bond issue for sewage treatment) all of the towns in the Shenango Valley have sewage treatment. The most unfavorable results in this valley were obtained below Sharon where about half of the sewage was being bypassed at the time samples were collected during remodeling activities at the sewage treatment plant. The area flooded by Pymatuning Reservoir was formerly a large swamp and the unstable organic matter in the swamp imparts an appreciable B.O.D. to the impounded water.

In the Mahoning Valley, the addition of iron coagulants in the form of waste pickle liquors probably tends to coagulate and settle pollution in the river. In addition, multiple industrial reuse of the river water, causing higher water temperatures and increased time of flow, affords excellent conditions for self-purification. During periods of increased flow and lower temperature, much higher coliform counts and somewhat higher

B.O.D.'s than those observed would probably be found in the Mahoning and the Beaver. In fact, some of the highest coliform counts were the fall and winter observations made at the mouth of the Beaver.

In spite of the amount of pickle liquor discharged in the district, very few pH values found in the district were below 6. Only two pH values below six were observed in the June, July, August period of observation and two more below 6.0 were observed in the November, December, January period when the taste and odor study was being made. In all cases these pH values were well above 5.0.

Hardness in streams of the Shenango Basin and in the eastern tributaries of the Beaver was generally of the order of magnitude of 100 p.p.m. In the Mahoning valley hardness values up to 350 p.p.m. were observed.

Taste and Odor Survey - The data (Table B-5A) have been divided into two sections on the basis of the appearance of phenol in the Beaver at Beaver Falls. During the first period, phenol was present in the Mahoning River in the Youngstown area but self-purification had removed this pollution before the stream reached Beaver Falls. During the second period, due to lower temperatures and shorter times of flow, self-purification failed to remove the phenol from the river before it reached Beaver Falls, where it caused great difficulty in the production of a palatable water.

The laboratory determinations show that large quantities of phenol were entering the Mahoning River in four different sections where by-product coke plants are located.

Table B-5 Beaver River Basin - Selected Laboratory Data

River	Mahoning		Mahoning		Mahoning		Mahoning
Location	above	below	Waterworks	below	above	McD.Vle	Libert St.
	Alliance		Warren		Niles		Girard
River Miles Above:							
Conf. with Shenango	83	76	35.5	34	30.2	29.2	24.8
Mouth of Beaver	104	97	56.5	55	51.2	50.2	45.8
Period - 1940	July	July	July-Aug.	July-Aug.	July-Aug.	July-Aug.	July
Number of Samples	2	2	5	5	5	5	4
Flow in c.f.s.:							
Sampling Days	4	20	235	237	243	290	355
Water Temperature °C.	26.5	26.0	23.9	25.8	25.4	24.6	24.1
Coliforms per ml.	25	83	16	7,100	86	2,400	341
Dissolved oxygen ppm.	4.8	4.5	7.7	2.5	2.0	1.4	5.3
B.O.D.,5-day,p.p.m.	2.2	3.4	2.6	5.7	2.4	2.0	2.2

River	Mahoning		Mahoning		Mahoning		
Location	Division Street	Center Street	Sheet & Tube	Bridge Lowell-ville	Bridge Edinburg	Bridge Mahoning-town	near Mouth
	Youngstown		Campbell				
River Miles Above:							
Conf. with Shenango	22	16	15	10.5	5.5	1.5	0.5
Mouth of Beaver	43	37	36	31.5	26.5	22.5	21.5
Period - 1940	July-Aug.	July-Aug.	July-Aug.	July-Aug.	July-Aug.	July-Aug.	July-Aug.
Number of Samples	8	8	8	8	8	7	4
Flow in c.f.s.:							
Sampling Days	294	260	280	291	307	367	214
Water Temperature °C.	27.2	29.6	30.0	29.2	26.1	25.9	23.9
Coliforms per ml.	450	11,400	6,100	186	62	71	31
Dissolved oxygen ppm.	4.0	1.6	0.7	1.6	3.1	3.7	4.3
B.O.D.,5-day,p.p.m.	1.8	10.0	12.4	3.7	2.6	2.6	2.6

River	Shenango		Shenango		Shenango	Shenango	
Location	Riverside Hotel	below	Mercer St.	Clark St.	below Sharon-Farrell	above	below
	Greenville		Sharpsville			New Castle	
River Miles Above:							
Conf. with Mahoning	48	46.5	31	29.3	21	6.5	0.5
Mouth of Beaver	69	65.5	52	50.3	42	27.5	21.5
Period - 1940	July-Aug.	July-Aug.	July-Aug.	July-Aug.	July-Aug.	July-Aug.	July-Aug.
Number of Samples	5	5	5	5	5	6	5
Flow in c.f.s.:							
Sampling Days	122	133	226	262	268	274	325
Water Temperature °C.	20.8	21.3	22.4	22.6	23.7	22.7	21.4
Coliforms per ml.	41	280	233	22	1,800	98	58
Dissolved oxygen ppm.	7.6	6.6	7.8	6.9	4.4	5.9	6.8
B.O.D.,5-day,p.p.m.	3.6	4.1	3.4	3.3	5.0	6.9	6.4

River	Beaver	Beaver	Beaver	Neshan Cr	Connoquenessing Creek		
Location	bel.New Castle	Eastvale, B'r Falls	near Mouth	below Mercer	at	below	at
					Butler		Renfrew
River Miles Above:							
Mouth of Beaver	15.5	5.5	1.4	46.5	57.5	54.0	49
Period - 1940	July-Aug.	July-Aug.	Oct.	Aug.	July	July	July
Number of Samples	6	6	11	2	2	2	2
Flow in c.f.s.:							
Sampling Days	502	750	633	11	10	20	30
Water Temperature °C.	24	23.8	15.2	20.2	24.5	26.0	25.5
Coliforms per ml.	437	10	802	330	5	13	58
Dissolved oxygen ppm.	3.5	6.8	8.3	5.0	5.0	3.4	6.6
B.O.D.,5-day, p.p.m.	8.8	4.0	2.6	2.3	1.1	6.1	3.6

Table B-5A - Beaver River Basin - Laboratory Results of Taste and Odor Survey of Mahoning and Beaver Rivers from Warren, Ohio to mouth.

River	Location of Sampling Point	River Mile (1)	Number of Samples	Temp. °C.	Phenol-parts per billion			Threshold Odor Value			pH	Iron p.p.m.
					Max.	Min.	Ave.	Max.	Min.	Ave.		
PERIOD OF SELF-PURIFICATION (11/7/40-12/3/40) Average discharge Beaver River at Beaver Falls 2036 c.f.s.												
Mahoning	Above Warren	64.5	10	3.9	2	0	0.2	16	2	6	7.4	2.8
"	" Niles	51.2	4	4.0	250	80	156	16	8	10	6.5	27
"	Below "	50.2	10	6.3	220	70	141	16	4	8	6.3	17
"	(Division St.	43.0	10	7.6	140	2	87	16	4	8	6.4	11
"	Youngs-(Mahoning Ave.	40.3	10	12.2	320	5	164	32	4	13	6.6	6.4
"	town (Center St.	37.0	5	10.8	240	20	130	16	4	11	6.6	16
"	Campbell at Youngstown Sheet & Tube Br.	36.0	10	14.2	1600	30	777	256	16	80	6.3	18
"	Struthers Bridge	34.6	0									
"	Lowellville Bridge	31.5	8	15.2	1000	38	502	64	8	29	6.2	19
"	Mt.Jackson Hwy.Br.	22.5	8	7.8	800	10	156	32	8	15	7.1	1.3
Shenango	New Castle Viaduct	23.0	8	5.2	0	0	0	16	2	6	6.9	5.5
Beaver	Above Beaver Falls	5.5	8	4.1	2	0	0.2	8	2	4	6.7	5.3
PERIOD OF PHENOLIC CONTAMINATION (12/4/40 - 1/10/41) Average discharge Beaver River at Beaver Falls, 6330 c.f.s.												
Mahoning	Above Warren	64.5	13	2.1	2	0	.15	8	2	3	7.0	1.1
"	" Niles	51.2	13	4.0	600	0	141	16	2	8	6.4	18
"	Below "	50.2	13	3.6	180	0	83	16	2	6	6.4	12
"	Youngs-(Division St.	43.0	13	4.3	120	0	61	8	2	5	6.4	13
"	town (Mahoning Ave.	40.3	13	5.6	800	10	223	8	4	6	6.4	13
"	(Center St.	37.0	13	6.9	400	30	159	64	4	27	6.5	11
"	Campbell at Youngstown Sheet & Tube Br.	36.0	13	7.4	1000	60	570	128	16	41	6.4	13
"	Struthers Bridge	34.6	10	8.5	2000	90	929	256	16	59	6.5	16
"	Lowellville Bridge	31.5	11	8.0	1800	160	824	128	16	41	6.5	16
"	Mt.Jackson Hwy. Br.	22.5	11	8.3	1800	50	685	128	8	29	6.6	9
Shenango	New Castle Viaduct	23.0	10	3.9	15	0	3.5	8	0	3	6.8	2.4
Beaver	Above Beaver Falls	5.5	11	4.8	230	35	108	64	2	11	6.7	2.3

(1) Miles above mouth of Beaver River.

Fig. B-3

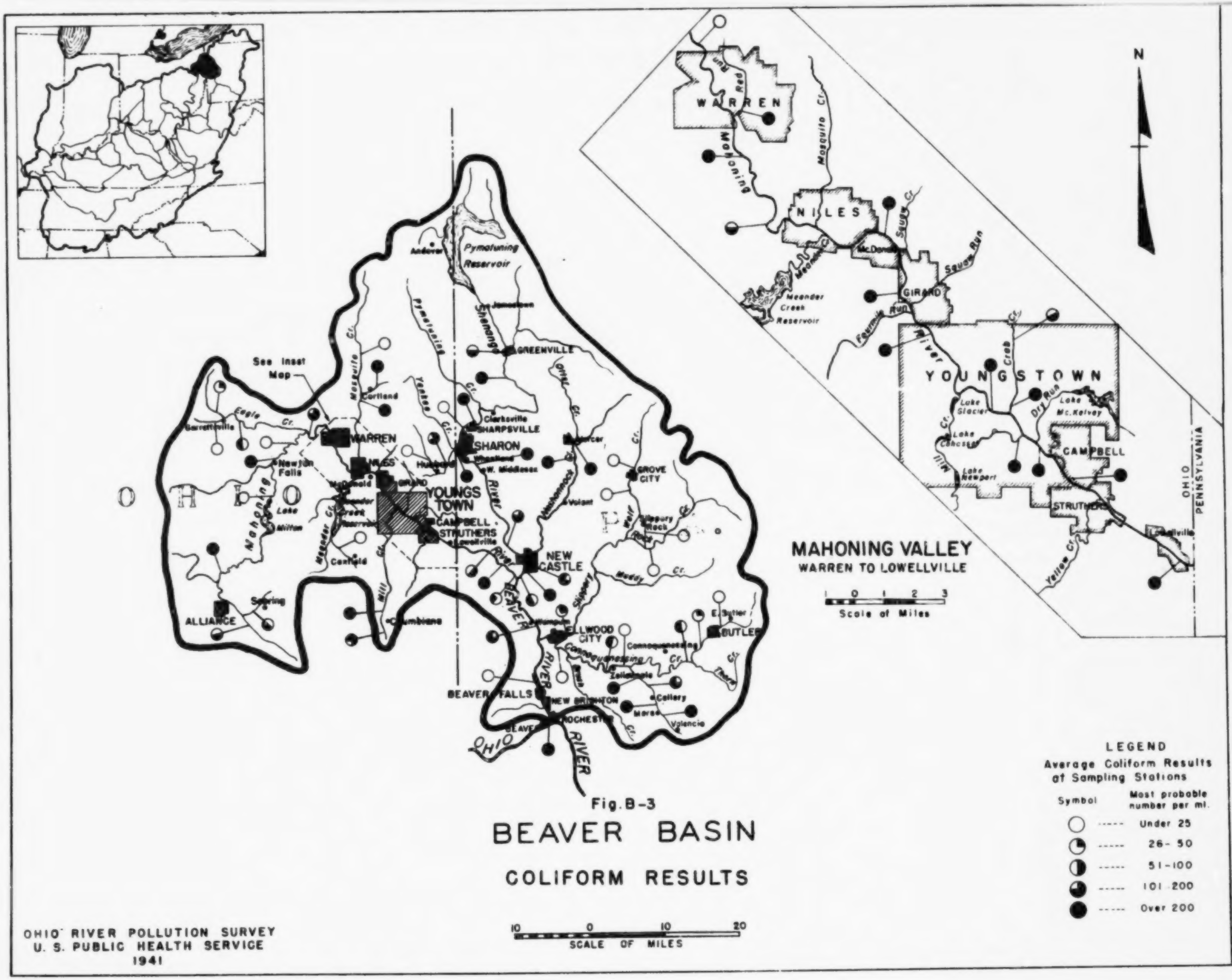


Fig. B-3

BEAVER BASIN

COLIFORM RESULTS

OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941

MAHONING VALLEY
WARREN TO LOWELLVILLE
1 0 1 2 3
Scale of Miles
N
WARREN
Red Run
Mahoning
Mosquito Cr.
NILES
Meander Cr.
Meander Creek Reservoir
McDonald
Squaw Cr.
Squaw Run
GIRARD
Fourmile Run
River
Crab Cr.
YOUNGSTOWN
Lake Glacier
Lake Cohasset
Mill Cr.
Lake Newport
Dry Run
Lake McKelvey
CAMPBELL
STRUTHERS
Lowellville
Yellow Cr.
OHIO
PENNSYLVANIA
LEGEND
Average Coliform Results at Sampling Stations
Symbol
Most probable number per ml.
○ ----- Under 25
◔ ----- 26-50
◑ ----- 51-100
◕ ----- 101-200
● ----- Over 200
10 0 10 20
SCALE OF MILES
OHIO
PA.
See Inset Map
Garrettsville
Eagle Cr.
Newton Falls
Mahoning
Lake Milton
Meander Cr.
Meander Creek Reservoir
Canfield
ALLIANCE
Sebring
Columbiana
Mill Cr.
Mosquito Cr.
Cortland
WARREN
NILES
McDonald
GIRARD
YOUNGS TOWN
CAMPBELL
STRUTHERS
Lowellville
Hubbard
Yankee Cr.
Pymatuning Cr.
Andover
Pymatuning Reservoir
Jamestown
Shenango
GREENVILLE
Clarksville
SHARPSVILLE
SHARON
Wheatland
W. Middlesex
River
Otter Cr.
Mercer
Neshannock Cr.
Volant
GROVE CITY
Wolf Cr.
Slippery Rock
Muddy Cr.
NEW CASTLE
BEAVER
Slippery Rock
Wampum
ELLWOOD CITY
Connoquenessing
Connoquenessing Cr.
Brush
Zelienople
E. Butler
BUTLER
Thorn Cr.
Callery
Mars
Valencia
BEAVER FALLS
NEW BRIGHTON
ROCHESTER
BEAVER
RIVER
OHIO
RIVER

Fig. B-4

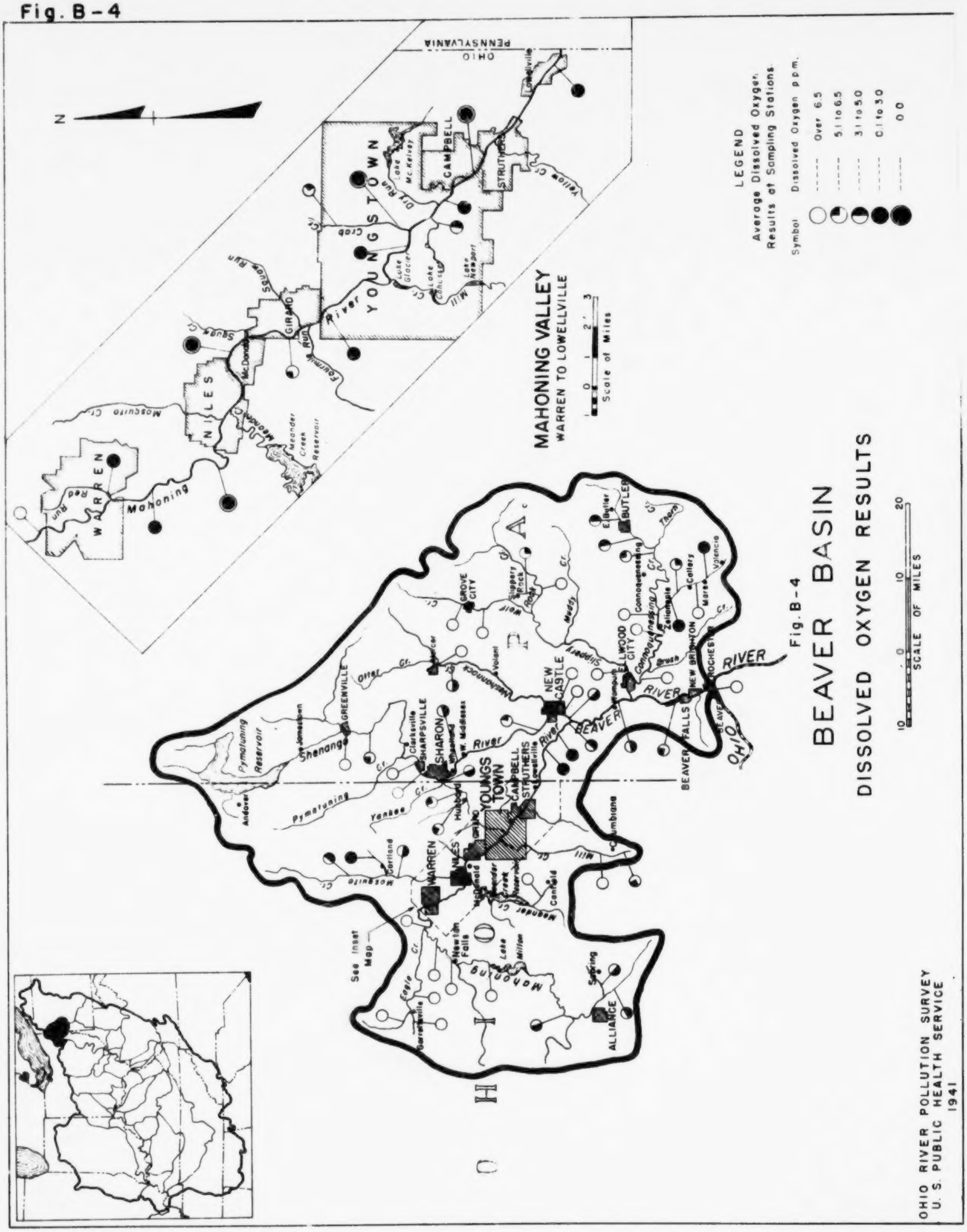

BEAVER BASIN
DISSOLVED OXYGEN RESULTS
Fig. B-4
SCALE OF MILES
10 0 10 20
MAHONING VALLEY
WARREN TO LOWELLVILLE
Scale of Miles
0 1 2 3
LEGEND
Average Dissolved Oxygen Results at Sampling Stations
Symbol Dissolved Oxygen p.p.m.
○ Over 6.5
5.1 to 6.5
3.1 to 5.0
0.1 to 3.0
● 0.0
N
OHIO
PENNSYLVANIA
WARREN
NILES
GIRARD
McDonald
YOUNGSTOWN
CAMPBELL
STRUTHERS
Lowellville
Mahoning
River
Mosquito Cr.
Meander Creek Reservoir
Squaw Cr.
Mill Cr.
Dry Run
Crab Cr.
Yellow Cr.
Lake Glacier
Lake Cohasset
Lake Newport
Lake McKelvey
SHARON
SHARPSVILLE
GREENVILLE
NEW CASTLE
ELLWOOD CITY
BUTLER
BEAVER FALLS
NEW BRIGHTON
ROCHESTER
BEAVER
ALLIANCE
GROVE CITY
Shenango
Pymatuning Reservoir
Beaver River
OHIO
Slippery Rock Cr.
Connoquenessing Cr.
Neshannock Cr.
Mercer
Hubbard
Columbiana
Sebring
Newton Falls
Garrettsville
Canfield
Cortland
Andover
Yankee Cr.
Eagle Cr.
Lake Milton
See Inset Map
O H I O
P A
OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941

Fig. B-5

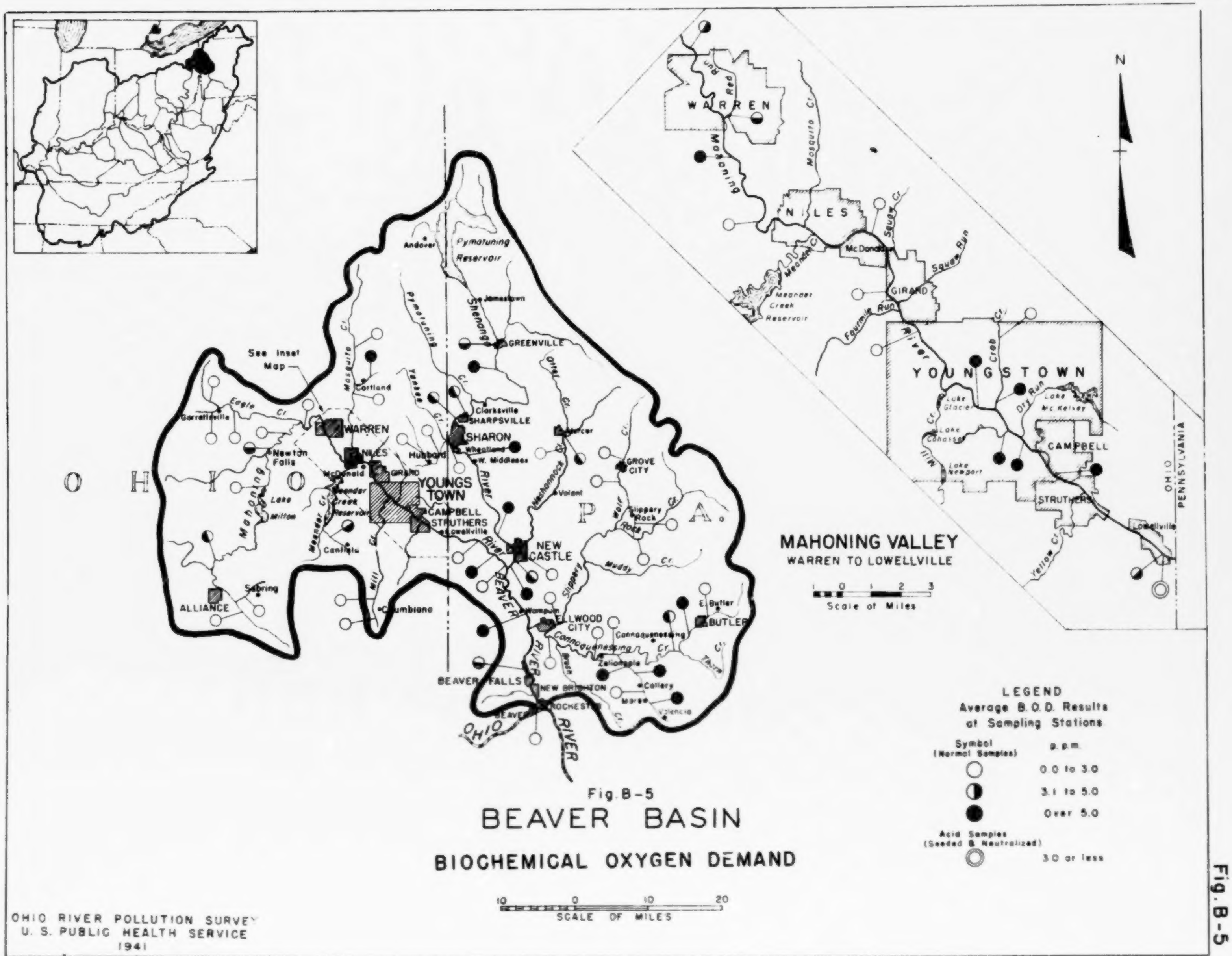

MAHONING VALLEY
WARREN TO LOWELLVILLE
Scale of Miles
0 1 2 3
N
WARREN
Red Run
Mahoning
Mosquito Cr.
NILES
Meander Cr.
Meander Creek Reservoir
McDonald
Squaw Cr.
Squaw Run
GIRARD
Fourmile Run
River
Crab Cr.
YOUNGSTOWN
Lake Glacier
Dry Run
Lake McKelvey
Lake Cohasset
Mill Cr.
Lake Newport
CAMPBELL
STRUTHERS
Yellow Cr.
Lowellville
OHIO
PENNSYLVANIA
LEGEND
Average B.O.D. Results at Sampling Stations
Symbol (Normal Samples) p.p.m.
○ 0.0 to 3.0
◐ 3.1 to 5.0
● Over 5.0
Acid Samples (Seeded & Neutralized)
◎ 3.0 or less
O H I O
P A.
See Inset Map
Garrettsville
Eagle Cr.
Newton Falls
Mahoning
Lake Milton
ALLIANCE
Sebring
WARREN
Cortland
NILES
McDonald
Meander Creek Reservoir
Meander Cr.
Canfield
GIRARD
YOUNGSTOWN
CAMPBELL
STRUTHERS
Lowellville
Mill Cr.
Columbiana
Mosquito Cr.
Yankee Cr.
Pymatuning
Andover
Pymatuning Reservoir
Jamestown
Shenango
GREENVILLE
Clarksville
SHARPSVILLE
SHARON
Wheatland
W. Middlesex
Hubbard
River
Otter Cr.
Mercer
Neshannock Cr.
Volant
GROVE CITY
Wolf Cr.
Slippery Rock Cr.
Muddy Cr.
NEW CASTLE
Slippery
BEAVER
Wampum
ELLWOOD CITY
Connoquenessing
Connoquenessing Cr.
E. Butler
BUTLER
Thorn Cr.
Zelienople
Callery
Mars
Valencia
Brush Cr.
BEAVER FALLS
NEW BRIGHTON
ROCHESTER
BEAVER
RIVER
OHIO RIVER
SCALE OF MILES
10 0 10 20

Fig. B-5

BEAVER BASIN

BIOCHEMICAL OXYGEN DEMAND

OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941

Hydrometric Data

Twenty-one stream gaging stations have been maintained in the Beaver River Basin at various times and 14 are currently in operation. Table B-6 shows monthly mean summer flows at eight stations for the three driest summers of record. Stream flow at Sharon and Wampum have been affected by the Pymatuning Reservoir since 1933 so the records shown in Table B-6 for these stations do not represent conditions likely to recur. Figure B-6 shows the effect of the reservoir on the flow at Sharon. It also shows the flow in the Mahoning at Youngstown based on 18 years of record and the flow as it would be regulated by the proposed Berlin Reservoir. Figure B-6 indicates that the frequency with which minimum monthly mean summer flows have occurred is as follows:

Location	Minimum Monthly Mean Summer Flows in Cubic Ft. per Sec. that may be expected once in			
	2 Years	5 Years	10 Years	Minimum
Mahoning at Youngstown	133	94	75	47
Mahoning at Youngstown Regulated by Berlin Res.	183	165	162	160
Shenango at Sharon (Unregulated at Pymatuning)	54	33	21	7

Proposed Stream Control - The Corps of Engineers has determined four sites to be most nearly satisfactory for flood control and allied reservoir development in connection with the program for Ohio River flood control as follows:

Reservoir	Stream	River Miles Above Mouth of Beaver River	Storage Acre-Ft.	Supplemental Flow Made Available c.f.s.	Approx. Minimum Regulated Summer Discharge at Project Sites-c.f.s.
Shenango	Shenango R.	54	127,000	100	(1) 300
Berlin (2)	Mahoning R.	94	71,000	113	(3) 160
Eagle Cr.	Eagle Creek	65	48,100	31	43
Mosquito Cr.	Mosquito Cr.	59	50,000	34	35

(1) Includes effect of Pymatuning.
(2) Under construction - 1942.
(3) Ultimate at Youngstown.

It is assured that low-flow control will be made available in the near future by the Berlin Reservoir project, and, during the present national emergency, it is proposed to operate the reservoir primarily for low-flow control with flood control as an incidental feature. Plans for ultimate operation contemplate its use for flood control, with secondary low water regulation. The Berlin project, operated in conjunction with existing Milton Reservoir several miles downstream, will permit sustaining a minimum flow of about 250 second-feet in the Mahoning River at Youngstown, Ohio, during the national emergency period, and about 160 second-feet under the ultimate plan of operation. The Eagle and Mosquito Creek projects would be capable of further augmenting discharge in the main river as well as increasing minimum flows in their respective tributary channels.

The Shenango project, if provided, would be operated with due regard for flow regulation originating in the Pymatuning Reservoir, which is situated further upstream. Proposed operations contemplate increasing the regulated flow of the Shenango River by 100 second-feet during the months of June to September, inclusive. Minimum regulated discharge at Sharon, Pennsylvania, which would reflect operation of both reservoirs, would approximate 300 second-feet during these months.

Table B-6 Beaver River Basin - Monthly Mean Summer Flows for Years in Which Low Summer Flows have Occurred.

River Location	Mahoning R. Warren, Ohio	Mahoning R. Youngstown, Ohio	Shenango at Sharon, Pa.	Shenango at New Castle, Pa.
River Miles Above: Mouth of Beaver	56.5	41.8	45.5	24.3
Drain.Area Sq.Mi.	599	899	608	792
Period of Record	1924-35	1921-39	1909-38	1910-34
Year	1930	1930	1916	1933
June c.f.s.	124	177	128	207
July "	80	104	18	40
August "	35	47	7	18
September "	37	56	9	26
Year	1934	1934	1930	1930
June "	44	66	99	142
July "	43	66	53	67
August "	83	198	14	25
September "	195	274	18	30
Year	1933	1933	1932	1923
June "	179	280	70	102
July "	59	82	120	31
August "	55	86	27	26
September "	44	71	17	36

River Location	Beaver R. at Wampum, Pa.	Mosquito Cr. Niles, Ohio	Connoquenessing Cr. at Hazen,Pa.	Slippery Rk. Cr.at Wurtemburg,Pa.
River Miles Above: Mouth of Beaver	15.4	51	23	18.5
Drain.Area Sq.Mi.	2,235	139	356	406
Period of Record	1914-18 1933-39	1929-39	1920-39	1912-39
Year	1916	1933	1930	1930
June c.f.s.	1,884	11.5	254	233
July "	559	2.3	26	66
August "	167	0.1	11	35
September "	153	0.2	11	40
Year	1933	1934	1939	1914
June "	720	0.3	290	184
July "	203	0.2	139	67
August "	156	23.6	54	38
September "	157	6.1	17	48
Year	1934	1930	1923	1932
June "	222	6.2	234	84
July "	201	1.4	40	127
August "	970	0.2	20	49
September "	578	0.2	21	42

Fig. B-6

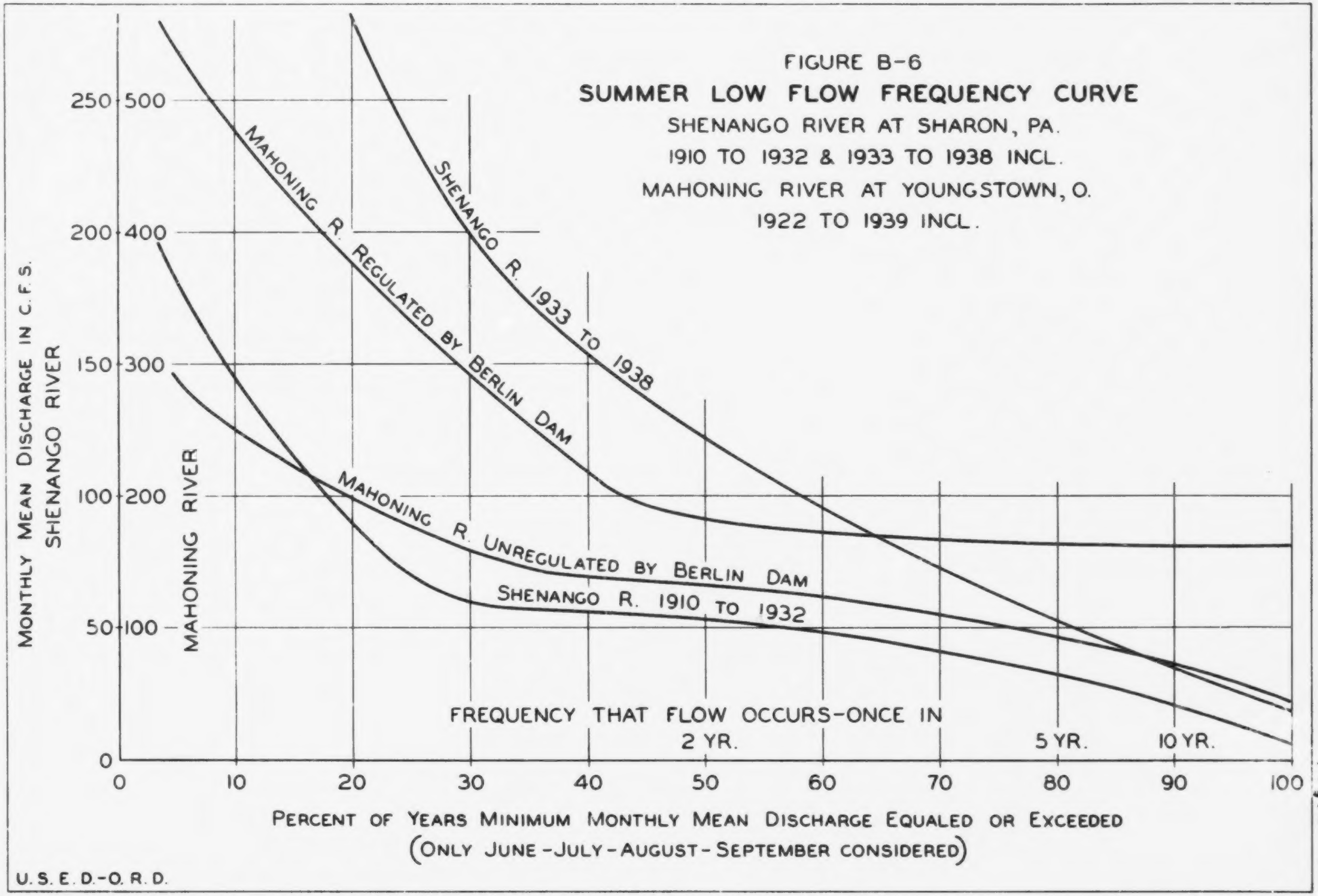


FIGURE B-6

SUMMER LOW FLOW FREQUENCY CURVE

SHENANGO RIVER AT SHARON, PA.
1910 TO 1932 & 1933 TO 1938 INCL.
MAHONING RIVER AT YOUNGSTOWN, O.
1922 TO 1939 INCL.

Discussion

Youngstown District - The Mahoning and Beaver Rivers are among the most grossly polluted streams in the Ohio Basin, if not in the entire country. In the 25-mile stretch of the Mahoning from Warren to Lowellville, untreated sewage from 280,000 people, industrial wastes equivalent to sewage from an additional 150,000 people and about 32 tons of sulfuric acid per day are discharged to the river whose flow has fallen to less than 50 c.f.s. A total of about 630 m.g.d. (about 980 c.f.s.) is used by the industries, principally for cooling water, in this same stretch of river with the result that the temperature rises to 30°-40°F. above normal during low-flow periods. These increased temperatures hinder production and increase costs. At certain times steel production has had to be reduced because of low stream flows. Increased temperatures also accelerate the decomposition of the organic matter present in the sewage and industrial wastes and reduce the amount of dissolved oxygen which the water can contain. Both of these effects tend to aggravate nuisence conditions in the stream. Complete depletion of the dissolved oxygen in the Mahoning was found at several points during the survey.

Three public water supplies from the Beaver River are affected by all the wastes entering the Mahoning as well as the treated wastes which are discharged to the Shenango River. Taste and odor problems are particularly acute at these places and even after very complete and careful treatment the finished water is often malodorous and unpalatable.

Survey information on taste and odor determinations on the Mahoning River were released to the State of Ohio and served as a basis for phenol control discussion with the industries. As a result, it is reported that the efficiency of phenol removal measures has been greatly increased.

Sewage and industrial waste treatment is obviously necessary both to improve conditions locally along the Mahoning and to relieve the heavy pollution of the Beaver River water supplies. The intensive development of the river valley in the Youngstown area where industrial plants and railroads occupy almost all of the available space will complicate the sewage treatment problem. Complete treatment would be much more expensive than usual because of the difficulty of acquiring suitable sites. There seems to be no economic justification for attempting to maintain a dissolved oxygen level suitable for fish propagation in this stretch of the river. The high temperature of the river water would make the stream unsuitable for any fish native to this area and the highly industrialized nature of the valley makes the stream unattractive for recreational use.

Chemical treatment of sewage and such industrial wastes as can be effectively treated in the municipal plants together with a maximum of recovery and reuse of wastes at the by-product coke plants (with particular attention to phenol removal), neutralization or other treatment of acid wastes are essential elements in a practicable program for pollution abatement in the Mahoning Valley.

Low-flow augmentation by reservoirs seems to be another essential part of any practicable program for improving the stream quality. Such low-flow control would reduce stream temperatures and benefit industrial water users and would reduce the hardness of the water as well as supplement sewage treatment and industrial waste corrective measures in the abatement of pollution from organic wastes. The benefits from low-flow control by the Berlin reservoir now (1942) under construction are estimated at $251,000 annually, provided the entire capacity is used for flow regulation as is planned for the period of the national emergency. The approximate distribution of the annual benefits is as follows:

Organic Pollution Abatement	$133,000
Industrial Water Supply- Temperature reduction and increased industrial activity made possible	112,000
Hardness Reduction	6,000
Total	$251,000

Under the ultimate plan of operation, or after the national emergency, the reservoir will be used primarily for flood control. One-third of the reservoir capacity will be used during the off-flood season for flow regulation. Annual flow regulation benefits will then be reduced to $111,000.

Additional flow regulation by Eagle Creek and Mosquito Creek reservoirs would have additional benefits. However, sewage treatment is necessary if full benefits are to be realized. Low-flow augmentation alone, or without the parallel program of sewage treatment, will actually have a detrimental effect on pollution conditions in the Beaver River because of decreased time of flow. This is particularly true as regards bacterial and taste and odor conditions.

No amount of flow regulation will entirely supplant sewage or industrial waste treatment measures but will supplement them. In the case of the most troublesome type of industrial waste, phenols, flow regulation by the proposed reservoirs would have no appreciable effect.

The Mahoning River presents a most promising situation for the advantageous use of low-flow augmentation. Monetary benefits are substantial and intangible values connected with any program of pollution control furnish additional incentive. However, due in part to the comparatively high storage costs experienced in this locality, even the Berlin Reservoir cannot be shown to be economically feasible for low-flow control alone. A multiple-purpose project has been shown to be economically feasible.

Treatment methods as outlined and maximum emergency period low-flow control by the Berlin Reservoir, together, would still not insure the continuous maintenance of 3.0 parts per million of oxygen in the Mahoning which is regarded as a minimum necessary to prevent nuisance conditions. However, such conditions would prevail only for a short distance and at infrequent intervals. The quality of the water at downstream water intakes would be greatly improved.

Shenango River - There are no serious pollution problems along this stream. All of the wastes entering the river are treated and flow regulation by Pymatuning Reservoir aids further in improving the water quality. Additional regulation by the proposed Shenango Reservoir would be of value, particularly in improving the quality of water in the Beaver River but the monetary benefit would be relatively minor.

Other Streams - On the whole, the smaller tributary streams of the Beaver Basin are not heavily polluted. Almost all of the towns have sewage treatment facilities although a number of them are inadequate. In general, secondary treatment is indicated at these places. At Newton Falls and Craig Beach on the Mahoning between the proposed Berlin Reservoir and Warren and at New Brighton, the only sizable Pennsylvania town without sewage treatment, primary treatment is indicated.

Costs - The estimated cost of the suggested program of sewage and industrial waste treatment, together with estimates of the cost of existing works and of possible programs for primary or for secondary treatment of all wastes are shown in Table B-1.

TABLE B-7 BEAVER RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth		Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Fish Run 3 miles below Sebring, Ohio	BMaF	104	June 28	1	20.0	5.0	55.1	1.9	91	7.2	26	101	252
" "	"	"	July 10	1	24.0	5.0	58.3	1.3	4	7.6	20		260
" "	"	"	" 29	2	26.0	3.2	38.4	2.7	43	6.9	28		220
Mahoning River 1 mile east of Alliance, Ohio	BMa	104	June 28	36	20.5	7.4	81.1	1.3	93	7.4		117	
" "	"	"	July 10	3	24.0	5.9	69.2	1.2	4	7.6			
" "	"	"	" 29	6	27.0	3.7	45.5	3.2	46	7.3			
Mahoning River 5 miles below Alliance, Ohio	BMa	97	June 28	42	21.0	5.4	59.8	3.6	430	7.5	37	136	174
" "	"	"	July 10	7	24.0	4.2	49.8	3.3	73	7.6	23		194
" "	"	"	" 29	34	27.0	4.8	59.2	3.4	93	7.3	32		156
Mahoning River 3 miles abv. Newton Falls, Ohio	BMa	79	July 1	93	16.5	8.3	84.7	2.2	4	7.4		53	
" "	"	"	" 15	132	22.0	8.9	101.0	1.8	2	7.3			
" "	"	"	" 22	130	25.0	7.9	94.0	1.0	24	7.2			
" "	"	"	July 30	88	27.5	7.0	87.5	3.0	24	7.3			
" "	"	"	Aug. 5	86	25.0	7.4	88.1	2.6	24	7.3			
Mahoning River lower edge of Newton Falls, O.	BMa	76	July 1		16.0	7.2	72.4	1.9	230	7.4		49	
" "	"	"	" 15	147	21.0	7.7	85.9	1.3	43	7.5			
" "	"	"	" 22	167	25.0	6.9	82.8	2.2	240	7.2			
" "	"	"	" 30	90	26.5	5.5	67.4	3.8	460	7.2			
" "	"	"	Aug. 5	90	24.5	6.3	75.0	4.2	93	7.2			
Mahoning River 4 miles below Newton Falls, Ohio	BMa	72	July 1	147	16.0	7.9	79.2	1.8	36	7.4		58	
" "	"	"	" 22	213	27.5	6.7	84.4	1.6	5	7.5			
" "	"	"	" 30	104	26.5	5.3	65.4	2.8	2	7.2			
" "	"	"	Aug. 5	101	24.5	6.6	78.5	1.9	24	7.2			
Silver Cr. 2 miles abv. Garrettsville, Ohio	BMaES	82	June 27		14.5	9.0	87.5	0.5	4	7.4		94	
" "	"	"	July 29	1	25.0	8.9	106.1	0.8	2	7.6	5		126
Eagle Creek 2 miles abv. Garrettsville, Ohio	BMaE	82	June 27		16.5	8.5	86.4	2.2	36	7.4	27	75	104
" "	"	"	July 11	3	21.0	7.0	73.0	0.9	2	7.4			
" "	"	"	" 29	3	24.0	6.6	77.3	4.7	46	7.4			
Eagle Creek 2 miles bel. Garrettsville, Ohio	BMaE	78	July 11	20	23.0	7.4	85.0	1.4	93	7.8	18		138
" "	"	"	" 29	9	26.5	6.5	80.2	1.6	23	7.7	12		144
Mahoning River Bridge North of Leavittsburg, Ohio	BMa	64.5	July 1	477	15.0	8.5	83.5	1.7	150	7.3		55	
" "	"	"	" 15	248	21.0	8.5	94.7	1.5	150	7.4			
" "	"	"	" 22	206	26.0	7.6	92.8	1.9	9	7.5			
" "	"	"	" 30	105	27.0	7.5	92.4		240	7.6			
" "	"	"	Aug. 5	112	24.5	7.7	90.7	2.0	4	7.3	15		116
Mahoning River Water works intake Warren, Ohio	BMa	56.5	July 1	567	17.0	7.7	79.5	2.4	36	7.3		47	196
" "	"	"	" 15	204	21.5	8.4	94.2	1.8	9	7.6	23		116

TABLE B-7 BEAVER RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml.	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
					p.p.m.	% Sat.						
Mahoning River Water works intake Warren, Ohio	BMa 56.5	July 22	200	26.5	7.5	91.9	1.8	9	7.4			
" "	" "	" 30	106	27.5	7.7	95.7	2.5	4	7.6			
" "	" "	Aug. 6	100	27.0	7.1	87.9	4.7	24	7.4	17		352
Red Run Erie R.R. Bridge Below Warren, Ohio	BMaR 56.0	July 1	5	16.0	2.4	23.6	2.9	73	7.3	16	126	
" "	" "	" 15		19.5	1.5	16.4	5.0	4	7.4	10		152
" "	" "	" 22	1	25.0	0.5	6.4	3.8	240	7.4			
" "	" "	" 30	**	25.5	0.8	9.8	6.7	240	7.2	10		180
" "	" "	Aug. 6	**	24.0	0.6	7.3	3.8	2,400	7.8			
Mahoning River 1 mile below Warren, Ohio	BMa 55.0	July 1	581	18.5	6.8	73.1	3.6	430	6.6		50	
" "	" "	" 15	180	24.0	2.2	26.0	10.4	930	6.1			
" "	" "	" 22	200	30.0	3.0	38.7	2.9	750	7.2	14		146
" "	" "	" 30	108	29.0	0.0	00.0	7.5	24,000	7.0			
" "	" "	Aug. 6	116	27.5	0.4	4.4	4.3	9,300	7.0			
Mahoning River 1 mile above Niles, Ohio	BMa 51.2	July 2	594	18.0	6.6	69.6	2.5	230	6.8	64	59	122
" "	" "	" 15	186	21.0	2.0	21.9	3.5	91	6.1			
" "	" "	" 22	192	30.0	1.3	17.3	1.9	23	6.1			
" "	" "	" 30	110	30.0	0.0	00.0	1.8	43	6.0			
" "	" "	Aug. 6	132	28.0	0.0	00.0	2.3	43	6.1			
Walnut Creek 1 mile above Cortland, Ohio	BMaMW 63.0	June 27	1	16.5	8.1	82.4	1.5	75	7.2	14	87	94
" "	" "	July 11	14	22.0	5.2	58.9	1.0	2,400	6.6	21		78
" "	" "	Aug. 5	**	24.5	1.4	17.0	13.7	4,600	7.6			
Mosquito Creek 4 miles above Cortland, Ohio	BMaM 64.0	June 27	23	16.5	6.4	64.9	2.5	23	7.1		78	
" "	" "	July 11	3	22.0	3.4	38.8	1.0	24	7.2			
" "	" "	Aug. 5	**	26.0	5.0	60.6	2.8	23	7.5	34		170
Mosquito Creek 2 miles below Cortland, Ohio	BMaM 58.0	June 27	32	18.0	5.9	62.1	2.2	36	7.3	19	108	122
" "	" "	July 11	19	22.5	3.5	39.9	2.7	460	6.4	34		116
" "	" "	Aug. 5	**	25.5	5.7	69.0	2.7	4	7.4	28		148
Saw Mill Creek Bridge on county road Canfield, Ohio	BMaMeS 60	July 3	1	22.5	12.3	140.7	3.6	36	9.2	12		256
" "	" "	" 29	**	23.5	6.0	69.7	3.1	9	7.8	8		184
" "	" "	Aug. 5	**	23.0	7.0	80.6	2.9	1	7.8	2		220
Mahoning River Niles McDonald Viaduct Below Niles, Ohio	BMa 50.2	July 2	705	18.5	6.4	67.5	3.5	430	6.6		43	
" "	" "	" 15		21.0	0.4	4.7	2.1	91	6.1	37		136
" "	" "	July 22	205	29.0	0.0	00.0	1.3	75	6.1	37		132
" "	" "	" 30	111	28.0	0.0	00.0	1.6	430	6.1			
" "	" "	Aug. 6	149	26.5	0.0	00.0	1.5	11,000	6.1			
Mahoning River Liberty St. Bridge Girard, Ohio	BMa 45.8	July 2	879	16.5	6.5	66.2	2.9	430	6.6		37	
" "	" "	" 16	251	23.0	5.7	65.4	2.4	430	6.4			
" "	" "	" 23	170	29.0	5.1	65.1	1.5	430	6.2			
" "	" "	" 30	120	28.0	4.1	51.3	1.8	73	6.1	34		190

TABLE B-7 BEAVER RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth		Date 1940		Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml.	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
							p.p.m.	% Sat.						
Mahoning River Division St. Bridge Youngstown, Ohio	BMa	43	July	2	1,210	16.5	7.1	72.2	3.4	2,400	6.8		46	
" "	"	"	"	16	256	22.5	5.2	59.2	1.6	91	6.2			
" "	"	"	"	23	199	29.0	4.1	52.5	1.2	43	6.1			
" "	"	"	"	31	134	29.5	3.5	45.2	2.0	240	6.1			
" "	"	"	Aug.	6	185	29.5	2.9	37.7	0.8	21	6.0			
" "	"	"	"	9	132	29.0	3.5	45.2	2.3	430	6.4			
" "	"	"	"	13	120	31.0	2.8	37.5	1.9	240	6.1			
" "	"	"	"	14	115	31.0	2.7	36.0	1.6	150	6.0			
Mill Creek 1 mile above Columbiana, Ohio	BMaMi	57.5	June	26	4	15.5	7.9	78.5	1.4	43	7.8		250	
" "	"	"	"	28	4	18.0	6.1	63.6	0.4	46	7.8			
" "	"	"	July	10	1	19.5	3.8	40.6	3.4	460	7.5			
Mill Creek 1 mile below Columbiana, Ohio	BMaMi	55.5	June	26	15	15.0	7.4	73.0	3.6	2,400	7.6	7	176	180
" "	"	"	"	28	15	17.0	7.2	74.1	1.1	73	7.4	8		214
" "	"	"	July	10	2	19.0	5.2	55.2	3.0	430	7.5	25		170
Mahoning River Spring Common Bridge Youngstown, Ohio	BMa	40.2	June	25		25.0	4.5	53.9	4.1	2,400	7.0		44	
" "	"	"	July	2	1,290	17.0	6.7	68.4	3.4	930	6.9	47		112
" "	"	"	"	16	259	24.5	2.7	31.6	3.2	2,400	6.5			
" "	"	"	"	23	178	32.5	2.1	28.6	2.4	2,400	6.6			
" "	"	"	"	31	140	33.0	2.4	33.5	3.9	9,300	6.3			
" "	"	"	Aug.	6	187	31.5	0.8	10.6	6.4	4,600	6.7	8		204
" "	"	"	"	9	134	31.5	2.3	30.6		9,300	6.7			
" "	"	"	"	13	124	32.5	1.9	25.5	5.0	4,600	6.6			
" "	"	"	"	14	117	32.0	1.8	24.3	5.4	4,600	6.7			
Crab Creek Applegate Road, Youngstown, Ohio	BMaC	41	July	2	17	15.5	9.3	92.4	1.1	21	7.2		67	
" "	"	"	"	16	1	18.5	7.5	79.1	1.1	4	7.5			
" "	"	"	"	23	2	25.0	3.8	45.6	1.0	23	7.4			
" "	"	"	"	31	1	25.0	5.9	69.9	1.9	240	7.4			
" "	"	"	Aug.	6	1	22.5	5.2	59.3	1.4	93	7.5			
" "	"	"	"	9	1	22.0	6.2	70.6	0.9	24	7.6			
" "	"	"	Aug.	13	**	25.0	5.7	67.5	4.5	9	7.4			
" "	"	"	"	14	**	24.5	6.1	72.4	2.0	24	7.4			
Crab Creek Bridge on Federal Ave. Youngstown, Ohio	BMaC	39.2	July	2	35	15.5	5.4	54.0	28.6	46,000	7.4	12	124	168
" "	"	"	"	16	10	18.5	0.0	00.0	33.2	46,000	7.3	32		164
" "	"	"	"	23	8	22.0	0.0	00.0	48.3	460,000	7.2	29		166
" "	"	"	"	31	8	22.5	0.0	00.0	22.8	93,000	7.3	26		240
" "	"	"	Aug.	6	9	23.0	0.0	00.0	24.7	93,000	7.2	23		222
" "	"	"	"	9	6	22.0	0.0	00.0	28.0	240,000	7.3	21		204
" "	"	"	"	13	4	24.0	0.0	00.0	57.4	240,000	7.2	35		208
" "	"	"	"	14	4	23.5	0.0	00.0	38.2	240,000	7.2	23		176
Gibson Run Poland Ave. Youngstown, Ohio	BMaG	38.5	June	25	1	21.5	5.1	57.0	12.4	36	9.6	42	690	680
" "	"	"	July	3	2	15.0	8.0	78.6	12.3	240	9.0	8	213	244
" "	"	"	"	16	2	18.5	7.1	75.0	11.2	24,000	9.0	17		310
" "	"	"	"	23	2	22.5	1.1	12.9	32.1	2	10.1			580

TABLE B-7 BEAVER RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth		Date 1940		Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml.	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
							p.p.m.	% Sat.						
Gibson Run Poland Ave. Youngstown, Ohio	BMaG	38.5	July	31	2	21.5	0.4	4.0	39.1	150,000	8.4	25		300
" "	"	"	Aug.	6	2	22.0	6.0	68.2	19.8	2,400	9.7	21		202
" "	"	"	"	9	1	20.0	7.2	78.6	6.2	910	9.3	12		330
" "	"	"	"	13	1	22.5	6.0	68.1	12.7	24,000	9.0	21		288
" "	"	"	"	14	1	22.0	5.5	61.9	21.3	15,000	9.1	18		252
Mahoning River Center St. Bridge Youngstown, Ohio	BMa	37.0	June	25	440	25.0	2.4	28.6	5.8	2,400	7.1		54	
" "	"	"	July	3	1,010	18.0	5.2	54.2	3.9	750	7.2			
" "	"	"	"	16	298	25.0	0.0	00.0	8.9	15,000	6.7			
" "	"	"	"	23	184	32.5	0.0	00.0	12.7	930	8.8			
" "	"	"	"	31	104	35.0	0.5	7.1	9.0	7,500	6.9			
" "	"	"	Aug.	7	120	30.5	0.0	00.0	10.2	24,000	6.8			
" "	"	"	"	9	119	30.0	7.2	94.5	10.9	15,000	7.0			
" "	"	"	"	13	125	32.0	0.0	00.0	15.5	24,000	6.6			
" "	"	"	"	14	123	34.0	0.0	00.0	8.6	4,300	6.6			
Mahoning River Youngstown Sheet&Tube Br. Youngstown, Ohio	BMa	36.0	June	25	450	26.5	2.6	32.2	5.2	430	7.1		39	
" "	"	"	July	3	1,050	19.0	5.2	55.1	5.3	1,200	7.0			
" "	"	"	"	16	287	26.0	0.0	00.0	16.6	4,300	6.4	46		146
" "	"	"	"	23	210	32.5	0.0	00.0	15.1	9,300	6.6			
" "	"	"	"	31	161	34.5	0.0	00.0	16.0	9,300	6.5			
" "	"	"	Aug.	7	135	32.5	0.0	00.0	8.8	15,000	6.3			
" "	"	"	"	9	139	29.5	0.0	00.0	10.5	4,300	6.4			
" "	"	"	"	13	134	32.5	0.0	00.0	16.4	4,300	6.4			
" "	"	"	"	14	130	33.0	0.0	00.0	10.8	930	6.1			
Mahoning River Bridge in Lowellville, Ohio	BMa	31.5	June	25	475	25.5	4.0	47.8	1.2	43	5.5		14	
" "	"	"	July	3	1,090	21.5	5.3	59.3	5.4	460	7.0			
" "	"	"	"	17	208	29.0	3.1	39.6	5.0	930	7.6			
" "	"	"	"	23	262	30.0	3.8	49.1	3.2	43	6.6			
" "	"	"	"	31	209	31.0	0.0	00.0	5.3	4	6.0			
" "	"	"	Aug.	7	134	29.0	0.5	6.9	3.7	43	6.4			
" "	"	"	"	9	145	30.5	0.0	00.0	0.6	**	6.1			
" "	"	"	"	13	140	31.5	0.0	00.0	5.6	4	7.2			
" "	"	"	"	14	140	31.5	0.9	11.4	0.8 1.3*	2	5.5			
Mahoning River Bridge on U.S. 224 Edinburg, Pa.	BMa	26.5	June	25	490	24.5	4.2	49.7	1.8	93	6.6		29	
" "	"	"	July	3	1,130	21.0	5.3	58.5	4.8	240	6.8			
" "	"	"	"	17	216	22.0	3.1	34.9	1.8	36	7.6			
" "	"	"	"	23	273	28.0	3.3	42.0	2.1	4	6.8			
" "	"	"	"	31	223	28.5	2.4	30.7	1.9	4	6.2			
" "	"	"	Aug.	7	154	26.0	1.9	22.9	3.2	150	6.9			
" "	"	"	"	9	152	26.5	3.0	36.6	3.3	2	7.0			
" "	"	"	"	13	155	28.5	3.2	40.9	1.8	9	6.9			
" "	"	"	"	14	155	28.0	2.6	32.7	2.0	46	6.6	8		

TABLE B-7 BEAVER RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth		Date 1940		Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliform M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
							p.p.m.	% Sat.						
Mahoning River ½ mile above mouth	BMa	21.5	July	5	83	19.3	5.2	55.8	4.3	93	7.4	25	55	112
" "	"	"	"	17	263	25.0	4.1	49.0	0.7	4	7.5	27		156
" "	"	"	"	23	289	27.5	4.2	52.1	3.9	1	7.4	5		144
" "	"	"	Aug.	7	220	23.9	3.7	43.1	1.6	24	7.2			210
Mahoning River Bridge on Pa. 108 Mahoningtown, Pa.	BMa	22.5	June	25	538	23.5	3.8	44.0	2.6	23	6.9	27	40	244
" "	"	"	July	3	1,260	22.0	5.1	58.2	5.9	460	6.8	47		124
" "	"	"	"	19	306	27.5	4.1	51.2	1.3	4	7.4	7		170
" "	"	"	"	31	240	28.0	3.1	38.9	2.6	9	7.3	5		212
" "	"	"	Aug.	7	216	24.0	2.9	34.2	2.3	9	7.3			
" "	"	"	"	9	211	25.5	3.2	38.7	1.8	2	7.1	5		252
" "	"	"	"	13	196	26.5	4.2	51.4	1.9	2	7.0	15		240
" "	"	"	"	14	140	27.5	3.6	45.4	2.1	8	7.3			256
Mahoning River-Br. on Pa 108-Mahoningtown, Pa.	BMa	22.5	Oct.	4		21.0	4.4	48.4	2.6	2	6.7	3	38	
" "	"	"	"	16		11.5	5.1	46.2	2.8	11	6.7	23	62	
" "	"	"	"	30		16.5	5.6	57.2	3.5	46	6.9	33	54	
" "	"	"	Nov.	15	395	12.0	5.6	51.9	1.6	2	6.7	9	45	
" "	"	"	"	28	925	13.0	7.5	70.5	3.7	46	6.7	12	53	
" "	"	"	Dec.	10	1,025	10.5	8.0	71.6	5.0	460	6.4	23	50	
" "	"	"	"	20	1,505	10.0	8.4	73.8	6.7	230	6.3	85	20	
" "	"	"	Jan.	3	2,910	7.0	10.2	84.1	5.1	930	6.5	85	29	
Shenango River Br. at Riverside Hotel Greenville, Pa.	BSh	69	July	4	75	17.0	8.3	85.6	1.6	23	7.4		66	
" "	"	"	"	13	145	21.0	7.9	87.8	2.4	110	7.4			
" "	"	"	"	24	126	25.0	7.5	89.0	3.9	23	7.4			
" "	"	"	Aug.	1	130	20.5	7.2	79.1	6.1	43	7.2			
" "	"	"	"	8	134	20.5	7.2	79.6	3.8	4	7.3			
Shenango River 3 miles below Greenville, Pa.	BSh	65.5	July	4	91	18.0	7.0	73.3	2.3	73	7.4		66	
" "	"	"	"	18	149	21.5	6.8	76.3	3.8	240	7.1			
" "	"	"	"	24	138	26.0	6.6	80.5	3.1	240	7.2			
" "	"	"	Aug.	1	153	21.0	6.1	68.1	6.3	460	7.2			
" "	"	"	"	8	135	20.0	6.4	[illegible]	[illegible]	390	7.3			
Shenango River Mercer St. Bridge Sharpsville, Pa.	BSh	52.0	July	4	293	21.0	9.2	102.0	1.8	15	7.5		58	
" "	"	"	"	18	313	23.5	6.7	77.9	2.2	1,100	7.2			
" "	"	"	"	24	133	25.5	7.3	87.9	3.0	23	7.4			
" "	"	"	Aug.	1	197	22.0	8.1	92.2	7.5	4	7.5			
" "	"	"	"	8	143	20.0	7.8	84.6	2.5	24	7.3			
Shenango River Clark St. Bridge Sharpsville, Pa.	BSh	50.3	July	4	325	20.5	8.8	97.1	2.0	23	7.5		57	
" "	"	"	"	18	352	24.0	6.4	74.4	2.7	23	7.3			
" "	"	"	"	24	186	26.0	6.1	74.6	2.0	23	7.4			
" "	"	"	Aug.	1	200	22.0	6.4	73.0	6.0	24	7.4			
" "	"	"	"	8	148	20.5	6.8	75.2	3.6	15	7.4			
Little Yankee Creek 1½ miles above Hubbard, Ohio	BShL	50	June	27	19	20.0	8.7	94.7	2.1	4	7.4		51	
" "	"	"	July	11	2	20.5	6.7	73.9	1.5	4	7.4			
" "	"	"	Aug.	5	2	23.0	5.6	64.7	1.7	4	7.3			

TABLE B-7 BEAVER RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth		Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
						p.p.m.	% Sat.						
Little Yankee Creek 4 miles below Hubbard, Ohio	BShL	47.0	June 27	30	19.0	9.7	104.0	1.0	36	7.4	5	55	78
" "	"	"	July 11	6	20.5	7.2	79.4	1.1	43	7.4	30		78
" "	"	"	Aug. 5	3	23.5	5.9	68.5	1.7	150	7.3	12		90
Yankee Run Bridge on U.S. 62 At Mouth	BShY	44.5	July 4	28	19.0	9.3	99.0	1.4	2	7.3	7	48	72
" "	"	"	" 18	8	23.5	7.2	84.1	1.6	24	7.2	20		74
" "	"	"	" 24	7	25.0	4.4	52.9	1.7	460	7.1	38		88
" "	"	"	Aug. 1	1	21.0	5.6	62.1	2.4	93	7.1	32		84
" "	"	"	" 8	**	21.5	5.0	55.6	2.3	240	7.2	13		92
Shenango River 4 miles below Sharon, Pa.	BSh	42	July 4	417	19.5	6.8	73.3	2.9	150	7.3	15	59	84
" "	"	"	" 18	376	25.0	6.0	71.7	2.7	240	7.1	31		74
" "	"	"	" 24	190	28.0	2.8	34.8	4.5	1,500	7.0	23		62
" "	"	"	Aug. 1	202	24.0	3.2	37.6	10.1	4,600	7.0	30		74
" "	"	"	" 8	154	22.0	3.2	36.5	4.9	2,400	6.9	25		84
Shenango River 3 miles above New Castle, Pa.	BSh	27.5	July 5	401	16.0	6.2	62.5	1.3		7.2		54	
" "	"	"	" 19	367	24.0	5.4	63.2	2.7	93	7.3			
" "	"	"	" 25	236	26.0	5.8	71.0	6.0	43	7.4			
" "	"	"	Aug. 2	215	22.5	5.4	61.5	12.7	23	7.1			
" "	"	"	" 7	267	22.0	7.1	80.5	11.0	93	7.3	20		112
" "	"	"	" 12	159	25.5	5.3	63.7	7.6	240	7.1			
Neshannock Creek Bridge Pa. 58 Mercer, Pa.	BShN	47.5	July 4	45	17.5	8.4	87.2	1.9	2	7.3		68	
" "	"	"	" 18	39	20.0	6.8	74.2	1.6	24	7.2			
" "	"	"	" 24	29	24.5	6.6	77.6	1.7	240	7.4			
" "	"	"	Aug. 1	4	20.3	7.1	77.7	7.6	460	7.2			
" "	"	"	" 8	11	21.0	7.5	83.8	2.4	240	7.4			
Neshannock Creek 1 mile below Mercer, Pa.	BShN	46.5	July 4	52	18.0	8.2	85.7	1.6	240	7.4	5	65	104
" "	"	"	" 18	43	20.0	5.6	61.1	1.4	930	7.2	18		104
" "	"	"	July 24	35	25.0	4.1	49.3	1.9	430	7.0			
" "	"	"	Aug. 1	12	20.0	5.0	54.1	2.6	430	7.2			
" "	"	"	" 8	12	20.5	5.1	56.1	2.0	230	7.2			
Neshannock Creek At mouth-upper edge of New Castle, Pa.	BShN	24.5	July 5	149	15.5	8.4	83.3	1.2	4	7.5	4	71	110
" "	"	"	" 19	85	23.0	8.2	94.8	3.2	2	7.5	8		114
" "	"	"	" 24	60	29.0	8.7	112.2	2.6	24	7.9	7		168
" "	"	"	" 19	85	23.0	8.2	94.8	3.2	2	7.5	8		114
" "	"	"	Aug. 1	43	22.5	9.4	107.9	2.3	43	8.3	3		192
" "	"	"	" 8	25	23.0	9.4	108.5	2.3	2	7.8	4		174
" "	"	"	Oct. 4		13.0	10.5	98.8	1.3	**	6.7	5	94	
" "	"	"	" 16		7.0	10.9	89.7	1.1	2	6.5	3	105	
" "	"	"	" 30		10.0	10.5	92.5	0.9	11	7.0	6	102	
" "	"	"	Nov. 15	95	3.5	12.3	92.5	0.8	46	6.8	3	63	
" "	"	"	" 28	260	3.5	13.8	103.8	2.6	240	6.6	10	47	
" "	"	"	Dec. 10	278	3.5	13.4	100.5	0.7	43	6.1	6	34	

TABLE B-7 BEAVER RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
					p.p.m.	% Sat.						
Neshannock Creek-Mouth New Castle, Pa.	BShN 24.5	Dec. 20	396	3.5	13.0	98.0	0.5	93	6.5	22	29	
" "	" "	1941 Jan. 3	715	3.5	12.6	94.5	0.7	230	6.6	12	29	
Shenango River Cherry St. Bridge New Castle, Pa.	BSh 23.0	July 17	258	19.5	8.7	93.5	4.0	150	7.9			
" "	" "	Oct. 4		16.0	9.4	94.7	2.6	240	6.5	8	50	
" "	" "	" 16		10.5	8.9	79.6	2.3	43	6.8	9	52	
" "	" "	" 30		12.0	8.8	81.0	2.6	93	6.9	17	53	
" "	" "	Nov. 15	274	5.0	11.1	36.4	1.9	460	6.9	8	56	
" "	" "	" 28	615	4.0	12.1	91.9	4.1	240	6.8	23	50	
" "	" "	Dec. 10	760	3.5	12.9	96.7	1.6	93	6.3	22	31	
" "	" "	" 20	1,035	3.5	12.5	93.8	1.2	93	6.6	7	31	
" "	" "	1941 Jan. 3	1,990	4.0	12.1	92.3	1.3	91	6.7	22	29	
Shenango River 1½ miles below New Castle, Pa.	Bsh 21.5	1940 July 5	422	16.0	7.5	75.7	2.2	4	7.4	9	57	78
" "	" "	" 19	453	24.0	6.8	79.8	4.8	93	7.4	27.		88
" "	" "	" 25	297	23.5	5.9	69.0	5.2	23	7.4	16		102
" "	" "	Aug. 2	258	20.0	6.7	73.3	14.1	93	7.2	21		114
" "	" "	" 12	195	23.5	7.0	81.2	5.6	75	7.2	20		94
Beaver River 8 mi. bel Chenton Wampum Bridge New Castle, Pa.	B 15.5	July 8	649	25.5	4.5	54.1	3.9	150	7.5	17	72	128
" "	" "	" 17	672	22.0	3.9	44.0	5.4	930	7.5			
" "	" "	" 25	425	26.0	2.3	27.5	9.4	230	7.2			
" "	" "	Aug. 2	396	22.0	3.5	39.2	17.2	150	7.1			
" "	" "	" 7	492	24.0	2.8	33.4	8.0	930	7.1			
" "	" "	" 12	380	24.5	3.7	43.7	9.2	230	7.0			
" "	" "	Oct. 4		17.5	5.3	54.6	4.5	460	6.7	8	45	
" "	" "	" 16		10.5	5.5	49.1	3.2	240	6.9	9	64	
" "	" "	" 30		13.5	5.5	52.5	5.4	230	6.8	19	57	
" "	" "	Nov. 15	772	5.0	8.1	63.5	2.1	1,100	6.7	6	52	
" "	" "	" 28	1,820	8.0	9.8	82.4	4.2	4,600	6.9	25	51	
" "	" "	Dec. 10	2,158	6.5	10.6	85.8	3.4	230	6.6	23	37	
" "	" "	" 20	3,080	6.0	10.1	80.8	3.3	230	6.4	55	23	
" "	" "	Jan. 3	5,925	5.0	11.3	88.0	3.7	430	6.7	55	32	
Br. Slippery Rock Creek 1½ miles below Slippery Rock, Pa.	BCoSl 42	July 5	38	17.5	8.8	91.0	1.2	6	7.4	15	56	86
" "	" "	" 19	39	24.0	2.6	30.1	1.0	4	7.4			
" "	" "	" 26		26.5	6.6	81.1	0.8	4	7.4	10		166
Slippery Rock Creek 3 miles south of Slippery Rock, Pa.	BCoSl 42	July 19		24.5	7.9	93.3	0.8	1	7.5	20		124
Wolf Creek Br. upper edge of Grove City, Pa.	BCoSlW 47.5	July 5	24	18.5	8.2	86.6	1.4	24	7.3		51	
" "	" "	" 19	11	24.5	5.7	67.9	2.3	8	7.1			
" "	" "	" 26	6	26.0	6.2	75.9	1.8	4	7.0			
Wolf Creek 2 miles bel. Grove City, Pa.	BCoSlW 45.5	July 5	31	17.5	8.9	92.5	2.0	9	7.4	13	56	82
" "	" "	" 19	11	22.0	9.3	105.0	2.0	2	7.6	14		108
" "	" "	" 26	7	22.0	7.5	84.5	1.7	23	7.4	10		114

TABLE B-7 BEAVER RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth		Date 1940		Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml.	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
							p.p.m.	% Sat.						
Slippery Rock Creek Above Ellwood City, Pa.	BCoSl	17.5	June	24	318	22.0	9.1	102.8	0.9	4	7.5	14	57	94
" "	"	"	July	9	142	23.5	9.3	108.6	2.0	91	7.6	17		96
" "	"	"	"	26	66	20.0	7.8	102.8	1.4	2	7.6	10		128
Connoquenessing Creek Bridge U.S. 422 Butler, Pa.	BCo	57.5	June	24	10	20.5	7.3	80.2	1.1	23	6.5		30	
" "	"	"	July	9	6	20.0	6.9	75.0	0.7	4	6.6			
" "	"	"	"	26	15	29.0	3.2	40.9	1.5	7	6.8			
Connoquenessing Creek 2 miles below Butler, Pa.	BCo	54.0	June	24	35	22.0	6.5	73.2	12.4	36	6.4		25	
" "	"	"	July	9	22	22.0	5.7	64.2	10.7	23	6.6			
" "	"	"	"	26	18	30.0	1.5	19.9	1.5	4	6.2			
Connoquenessing Creek Bridge Pa. 328 Renfrew, Pa.	BCo	49.0	June	24	62	21.5	6.8	76.5	3.0	91	6.6		34	
" "	"	"	July	9	39	22.0	6.3	71.2	4.6	93	6.7			
" "	"	"	"	26	21	29.0	6.8	87.3	2.5	23	6.9			
Breakneck Creek ½ mile above Mars, Pa.	BCoB	46	July	8	4	21.5	10.1	113.5	1.2	46	7.6		56	
" "	"	"	"	25	8	23.5	4.8	55.7	5.2	4,600	7.2			
" "	"	"	Aug.	2	**	20.0	1.2	12.9	6.0	11,000	7.2			
" "	"	"	"	12	**	23.0	4.3	49.1	4.9	430	7.4			
Breakneck Creek 1½ miles below Mars, Pa.	BCoB	44.5	July	8	8	21.0	9.5	105.6	2.5	1,100	7.5		63	
" "	"	"	"	25	3	22.5	7.6	87.2	2.4	930	7.5			
" "	"	"	Aug.	2	1	19.5	7.8	84.0	2.5	230	7.3			
" "	"	"	"	12	**	22.5	7.2	82.7	2.0	24,000	7.4			
Breakneck Creek SE corner of Evans City, Pa.	BCoB	41	July	8	24	23.0	10.6	122.6	1.9	110	7.8		64	
" "	"	"	"	25	5	25.5	6.1	73.5	3.1	43	7.4			
" "	"	"	Aug.	2	1	21.0	6.0	67.3	3.7	7	7.4			
" "	"	"	"	12	**	22.5	6.1	69.7	7.4	240	7.6			
Breakneck Creek 1 mile below Evans City, Pa.	BCoB	39.0	July	8	31	23.0	7.2	83.1	7.1	2,400	7.5	12	71	90
" "	"	"	"	25	6	26.5	6.7	82.1	6.5	4,300	7.4	28		112
" "	"	"	Aug.	2	1	20.5	4.5	49.2	15.0	4,300	7.1	33		124
" "	"	"	"	12	**	23.0	0.0	00.0	19.0	36	7.1	33		140
Connoquenessing Creek U.S. Route 19 Harmony, Pa.	BCo	36.0	June	24	131	21.5	8.2	91.9	1.9	4	7.2		38	
" "	"	"	July	9	82	23.0	8.7	100.7	1.6	1	6.9			
" "	"	"	"	26	32	29.0	6.9	89.1	3.5	4	7.2			
Connoquenessing Creek 2 miles below Zelienople, Pa.	BCo	31.5	June	24	149	21.5	7.7	86.5	1.8	23	7.2		37	
" "	"	"	July	9	93	21.5	8.0	89.9	1.3	21	7.2			
" "	"	"	"	26	33	29.5	7.3	94.9	3.4	93	7.4			
Connoquenessing Creek 1½ miles above Ellwood City, Pa.	BCo	17.0	June	24	210	23.0	9.1	105.1	1.8	4	7.3	16	37	112
" "	"	"	July	9	123	25.5	8.9	107.1	2.0	4	7.3	20		112
" "	"	"	"	26	52	29.0	8.3	107.3	4.0	24	7.5	30		120

TABLE B-7 BEAVER RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c. f. s.	Temp. °C	Dissolved Oxygen p. p. m.	Dissolved Oxygen % Sat.	5 Day B. O. D. p. p. m.	Coliforms M. P. N. Per ml	pH	Turbidity p. p. m.	Alkalinity p. p. m.	Hardness p. p. m.
Beaver River Eastvale Bridge Beaver Falls, Ohio	B 5.5	July 8	1,050	25.5	9.0	108.7	4.4	9	7.6		61	
" "	" "	" 17	880	22.0	7.4	83.9	3.9	9	7.3	18		150
" "	" "	" 25	690	25.0	5.9	70.9	2.5	9	7.2	13		154
" "	" "	Aug. 2	640	23.0	5.1	58.6	3.8	24	7.2	15		140
" "	" "	" 7	690	23.0	6.1	69.8	3.2	4	7.1	7		170
" "	" "	" 12	570	24.0	7.3	86.0	6.1	4	7.3	16		162
Beaver River At Mouth	B 1.4	Oct. 2	620	18.0	8.4	88.3	2.1	1,100	6.5	11	34	
" "	" "	" 4	575	17.0	8.4	86.2	1.6	430	6.2	12	24	
" "	" "	" 8	640	18.0	8.5	89.0	2.6	930	6.1	9	24	
" "	" "	" 10	640	17.0	8.5	86.9	2.4	460	6.0	10	14	
" "	" "	" 14	640	17.0	8.5	87.7	3.8	150	6.2	8	47	
" "	" "	Oct. 16	620	16.5	6.4	64.7	2.8	460	6.2	12	45	
" "	" "	" 18	640	15.0	7.8	77.0	1.9	930	6.2	12	27	
" "	" "	" 22	660	12.0	8.7	80.1	3.0	930	6.0	13	27	
" "	" "	" 24	640	12.0	9.0	85.3	2.2	2,400	6.3	11	21	
" "	" "	Oct. 28	575	12.0	9.2	84.9	3.9	230	6.4	12	58	
" "	" "	" 30	710	13.0	7.9	74.6	1.9		6.4	37	42	
" "	" "	Nov. 1	910	12.5	9.4	87.9	2.8	240	6.4	12	50	
" "	" "	" 5	1,320	12.5	9.8	91.8	2.4	43	6.5	22	48	
" "	" "	" 7	1,150	10.0	10.2	90.3	1.1	24	6.5	42	43	
" "	" "	" 13	2,130	9.0	11.0	94.5	1.8	110	6.8	24	47	
" "	" "	" 15	1,690	8.0	11.2	94.5	1.3	43	6.6	16	35	
" "	" "	" 19	1,150	5.0	12.2	95.3	1.8	150	6.6	20	37	
" "	" "	" 25	1,340	9.0	10.7	92.5	1.3	75	6.6	25	36	
" "	" "	" 27	2,650	7.0	11.2	92.3	1.6	460	6.6	30	35	
" "	" "	" 29	3,830	5.0	12.9	100.9	1.9	91	6.2	35	34	
" "	" "	Dec. 3	4,000	2.0	13.2	95.4	2.1	460	7.0	50	35	
" "	" "	" 5	2,340	2.0	13.4	97.1	2.8	93	6.5	23	28	
" "	" "	" 9	4,700	4.0	13.2	100.7	2.5	150	6.8	30	30	
" "	" "	" 11	3,050	5.0	12.2	95.4	2.0	240	6.3	23	28	
" "	" "	" 13	6,200	6.5	12.0	97.5	2.3	93	6.4	20	30	
" "	" "	Dec. 17	10,200	6.0	12.2	97.5	3.7	1,100	7.0	110	28	
" "	" "	" 19	5,930	4.0	12.9	98.1	2.1	430	6.8	50	26	
" "	" "	" 23	3,630	5.5	12.5	98.7	1.6	150	6.3	22	31	
" "	" "	" 27	2,730	7.0	11.8	97.3	1.0	1,100	7.0	23	33	
" "	" "	" 31	19,500	5.0	11.6	90.5	6.4	150	6.8	170	33	
" "	" "	1941 Jan. 2	15,500	5.5	12.6	99.4	3.3	210	6.6	70	28	

* Seeded and Neutralized

** Less than one

MUSKINGUM RIVER BASIN

Final Report to the Ohio River Committee

Ohio River Pollution Survey

U. S. Public Health Service
Cincinnati, Ohio
1942

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MUSKINGUM RIVER BASIN

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Fig. Mu-1

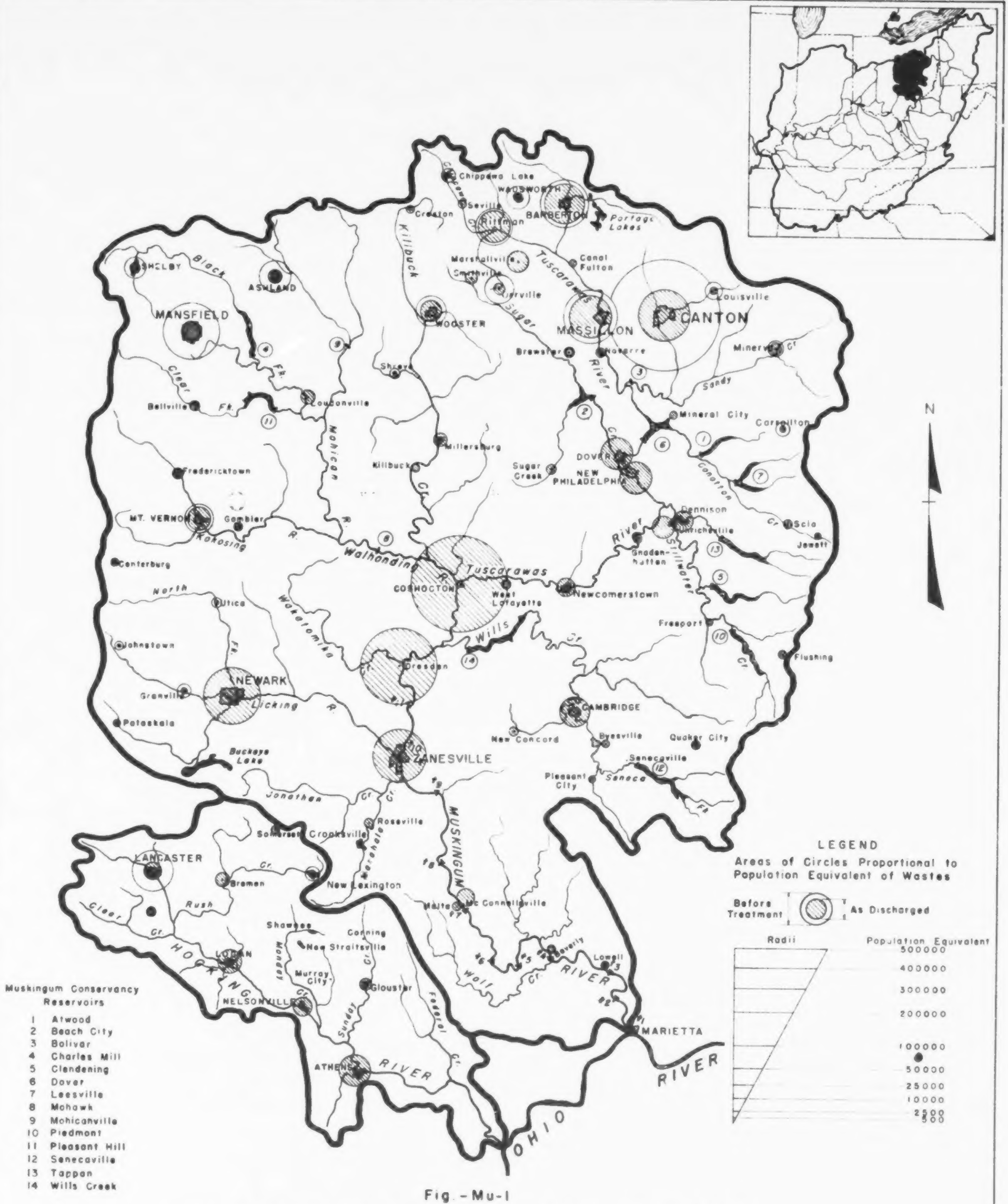

Chippewa Lake
Wadsworth
Seville
Creston
Rittman
Barberton
Portage Lakes
Killbuck
Marshallville
Smithville
Orrville
Canal Fulton
Tuscarawas
Louisville
Shelby
Black
Ashland
Mansfield
Wooster
Sugar
Massillon
Canton
Brewster
Navarre
River
Minerva
Sandy
Clear
Fk.
Shreve
Loudonville
Bellville
Mineral City
Carrollton
Nohican
Millersburg
Killbuck
Fredericktown
Sugar Creek
Dover
New Philadelphia
Conotton
Mt. Vernon
Gambier
Kokosing
R.
Walhonding
Dennison
Uhrichsville
Scio
Jewett
River
Stillwater
Gnadenhutten
Coshocton
Tuscarawas
West Lafayette
Newcomerstown
Centerburg
North
Utica
Wakatomika
Freeport
Johnstown
Fk.
Wills
Cr.
Flushing
Dresden
Newark
Granville
Licking
R.
Cambridge
Pataskala
New Concord
Byesville
Quaker City
Buckeye Lake
Zanesville
Senecaville
Pleasant City
Seneca
Fk.
Jonathan
Cr.
Roseville
Muskingum
Somerset
Crooksville
Moxahala
Lancaster
Cr.
Bremen
New Lexington
Rush
Clear
Cr.
Malta
McConnelsville
Shawnee
Corning
New Straitsville
Hocking
Logan
Monday
Murray City
Sunday Cr.
Glouster
Federal Cr.
Wolf
Cr.
River
Beverly
Lowell
Nelsonville
Marietta
Athens
River
Ohio
River
N
LEGEND
Areas of Circles Proportional to Population Equivalent of Wastes
Before Treatment
As Discharged
Radii
Population Equivalent
500000
400000
300000
200000
100000
50000
25000
10000
2500
500
Muskingum Conservancy Reservoirs
1 Atwood
2 Beach City
3 Bolivar
4 Charles Mill
5 Clendening
6 Dover
7 Leesville
8 Mohawk
9 Mohicanville
10 Piedmont
11 Pleasant Hill
12 Senecaville
13 Tappan
14 Wills Creek

Fig. - Mu-1

MUSKINGUM—HOCKING BASINS

SOURCES OF POLLUTION

10 0 10 20
SCALE OF MILES

OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941

MUSKINGUM RIVER BASIN

Syllabus and Conclusions

Syllabus

More than 800,000 people live in the 8,040 square miles in eastern Ohio drained by the Muskingum River. About 400,000 are in urban communities. Forty-six percent of the urban population is in the heavily industrialized portion of the basin drained by the upper Tuscarawas River and Sandy Creek. In spite of the extensive efforts made to abate pollution throughout the basin, a problem remains on the upper Tuscarawas and some of its tributaries.

The lower Muskingum River and certain tributaries are considered excellent fishing streams. Natural lakes and the conservation pools at the recently completed flood control reservoirs afford unusually good facilities for recreation. One of these, the Senecaville reservoir, might be used to augment low flows for pollution abatement below Cambridge.

The larger streams, except the upper Tuscarawas, can be restored to or maintained in excellent condition at a reasonable cost. Further limited improvements in the quality of the more heavily polluted Tuscarawas and some of its tributaries seem economically justified.

Conclusions

(1) All but nine of the 94 public water supplies in the basin are derived entirely from underground sources. Only four of the surface supplies are from streams subject to pollution.

(2) Sewage from 422,600 people and industrial wastes with a sewered population equivalent (B.O.D.) of about 321,000 enter the streams of the basin. About two-thirds of the sewage is treated, most of it receiving secondary treatment and 56 of 84 industrial plants have taken some step to reduce pollution from industrial wastes.

(3) Laboratory studies indicate that the most heavily polluted streams are in the northeastern part of the basin in the vicinity of Canton, Massillon and Barberton.

(4) Primary treatment of domestic sewage and removal of settleable solids from industrial wastes should suffice to maintain satisfactory stream conditions below 8 of the 10 urban communities now discharging untreated sewage. At Newark and Cambridge secondary treatment is indicated.

(5) Primary treatment seems justified at 16 and secondary treatment at 18 smaller rural communities now without sewage treatment facilities.

(6) Improvements or additions to existing sewage treatment plants are indicated at Canton, Mansfield and seven other communities.

(7) If the Senecaville reservoir can be used for low-flow control, primary treatment may suffice at Cambridge.

(8) The following summary of cost estimates are from Table Mu-1.

Treatment	Capital Cost	Annual Charges
Existing	$4,550,000	$440,000
Suggested additional	5,180,000	535,000

Estimated additional costs, over existing charges, of programs involving uniform treatment throughout the basin are:

Primary, all places	$4,370,000	$450,000
Secondary, all places	6,200,000	660,000

Table Mu-1 Muskingum River Basin - Estimated Cost of Existing and Suggested Minimum Corrective Measures for Sewage and Industrial Wastes, with Comparative Costs for Primary and Secondary Treatment.

	Number of Plants		Population Connected to Sewers	Capital Investment (Dollars)	Annual Charges (Dollars)		
	Prim.	Sec.			Amort. & Interest	Operation & Main.	Total
Existing Sewage Treatment	13	18	285,600	4,550,000	287,000	153,000	440,000
Suggested Minimum Correction							
Sewage Treatment Plants	23	20	136,600	2,650,000	185,000	105,000	290,000
Required Interceptors			-	2,220,000	105,000	-	105,000
Independent Industrial Waste Correction	-		-	310,000	40,000	100,000	140,000
Total				5,180,000	330,000	205,000	535,000
Comparative Cost							
Primary Treatment All Waste				4,370,000	270,000	180,000	450,000
Secondary Treatment All Waste				6,200,000	400,000	260,000	660,000
As Suggested				5,180,000	330,000	205,000	535,000

Description

The Muskingum River Basin comprises 8,040 square miles of eastern Ohio. The main stream is formed by the junction of its two principal tributaries, the Tuscarawas and Walhonding Rivers at Coshocton in about the center of the basin and flows south for 110 miles to its junction with the Ohio River at Marietta. The larger tributaries are:

Tributaries	Distance above Mouth of Muskingum R.	Drainage Area Square Miles
Licking River	75	790
Wills Creek	99	850
Walhonding River	110	2,250
Tuscarawas River	110	2,590

There are twenty-five urban communities in the basin and the population density is slightly more than 100 per square mile. The populations of the larger cities and of the basin as a whole for the past 30 years are tabulated below.

	Populations			
Larger Cities	1910	1920	1930	1940
Canton	50,217	87,091	104,906	108,401
Zanesville	28,026	29,569	36,440	37,500
Mansfield	20,768	27,824	33,525	37,154
Newark	25,404	26,718	30,596	31,487
Massillon	13,879	17,428	26,400	26,644
Barberton	9,410	18,811	23,934	24,028
Entire Basin				
Rural	381,840	384,460	387,879	413,578
Urban	239,011	317,620	389,687	398,450
Total	620,851	702,080	777,566	812,028

Much of the basin, particularly in the northern and western parts, is fertile agricultural country. The eastern and southern portions of the area are more hilly and agriculture is less prosperous. Coal mining is important in these sections although production is generally on the decline. The principal manufactured products are steel and other metals, metal products, machinery and clay products.

Water Uses - The Muskingum has been canalized by the construction of 11 locks and dams which maintain a navigable depth of five feet for 91 miles from Marietta to Dresden. The facilities are not used extensively. There are no important hydroelectric developments in the basin.

A system of fourteen reservoirs, primarily for flood control, constructed by the U. S. Engineer Department for the Muskingum Conservancy District at a cost of $45,000,000 was completed in 1938. It has since been taken over by the Federal Government and will be operated as part of the system of reservoirs for flood control on the Ohio River and its tributaries. Eleven of the reservoirs have permanent pools. These pools and adjoining land have been leased to the Ohio Division of Conservation for development as fishing and recreational areas. Data on the capacity of the reservoirs and the area of the conservation pools are tabulated below.

No.	Reservoir	Stream	Storage-Acre Feet		Area of Conservation Pool-Acres
			Total	Conservation	
1	Atwood	Indian Fork	49,700	23,600	1,540
2	Beach City	Sugar Creek	71,700	1,700	420
3	Bolivar	Sandy Creek	149,600	0	0
4	Charles Mills	Black Fork	88,000	7,400	1,350
5	Clendening	Brush Fork	54,000	27,900	1,800
6	Dover	Tuscarawas R.	203,000	1,000	350
7	Leesville	McGuire Creek	37,400	19,500	1,000
8	Mohawk	Walhonding River	285,000	0	0
9	Mohicanville	Lake Fork	102,000	0	0
10	Piedmont	Stillwater Creek	65,000	33,600	2,270
11	Pleasant Hill	Clear Fork	87,700	13,500	850
12	Senecaville	Seneca Fork	88,500	43,500	3,550
13	Tappan	L.Stillwater Cr.	61,600	35,100	2,350
14	Wills Creek	Wills Creek	196,000	6,000	900

These conservation pools, together with Buckeye Lake in the southwestern part of the basin and the numerous lakes in the vicinity of Akron, furnish the area with unusually good water recreation facilities. Some of the streams also are used extensively for recreation. The lower Muskingum and Wakatomica Creek are considered outstanding fishing streams.

Presentation of Field Data

Figure Mu-1 shows the location and magnitude of each source of pollution of consequence in the basin. Figure Mu-2 shows similar data and, in addition, the location of water supply intakes subject to pollution and laboratory data on coliform organisms, dissolved oxygen and biochemical oxygen demand.

Public Water Supplies - Eighty-five of the 94 public water supplies in the basin are from underground sources. These supply almost 75 percent of the total population of 471,200 served by water supplies. The underground water is generally satisfactory in quality although it is usually hard and sometimes must be treated to remove iron. Of the nine surface water supplies, only four are from streams subject to pollution. Table Mu-2 shows data on the surface water supplies of the basin.

A number of the communities which now use underground water exclusively are having difficulty in securing adequate supplies. Outstanding among these are Canton and Mansfield. In both instances heavy industrial drafts on the underground supply complicate the problem. Both of these cities may be forced to develop water supplies from surface sources.

Sewerage - Table Mu-3 shows the sewered population at each of the more important sources of pollution in the basin. About two-thirds of the total sewered population of 422,600 are served by sewage treatment plants. Thirteen primary treatment plants serve 78,700 people and 18 secondary treatment plants serve 206,900 people. The largest communities without sewage treatment are Zanesville, Newark, Cambridge, New Philadelphia and Coshocton.

Industrial Wastes - Four strawboard and paperboard plants account for almost 75 percent of the total population equivalent of 280,500 of all the industrial wastes in the basin not treated at municipal plants. The larger steel plants, concentrated in the northeastern part of the basin around Canton and Massillon have taken steps to dispose of waste pickling liquors. An alkali plant at Barberton discharges large quantities of inorganic salts which greatly increase the hardness of the Tuscarawas River. Table Mu-4 shows data on the industrial waste producing plants.

Table Mu-2 Muskingum River Basin - Surface Water Supplies

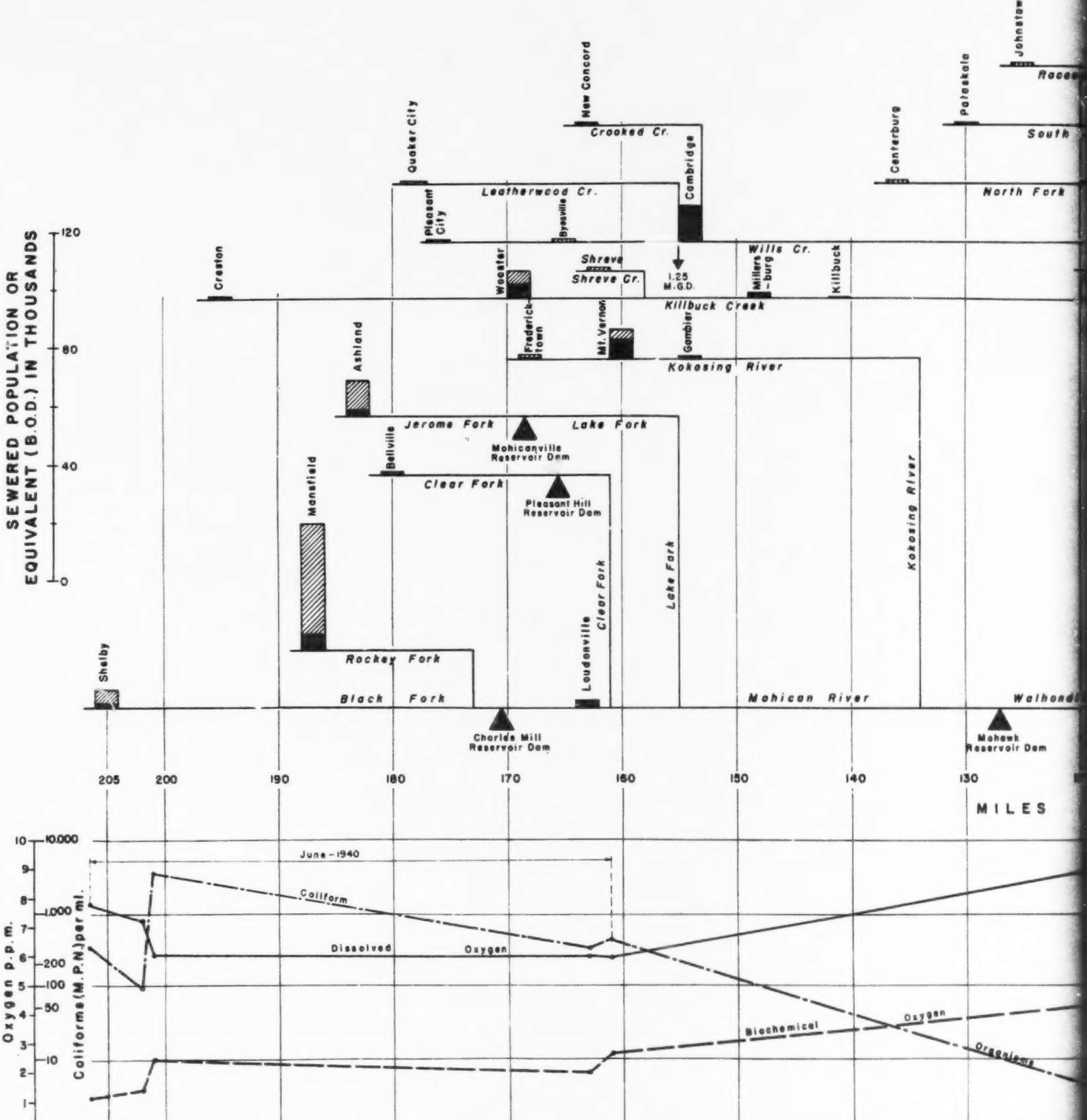
Municipality	Source	Mile (1)	Treatment (2)	Population Served	Consumption M.G.D.
Supplies Below Community Sewer Outfalls					
Newark	N. Fk. Licking R.	107	LD	35,000	3.20
Cambridge	Wills Creek	155	FD	15,000	1.25
Dennison	Stillwater Creek	160	FD	10,000	2.00
Marietta	Muskingum R.& Wells	2	LD	14,500	1.60
Other Surface Supplies					
Ashland	Jerome Cr.-Long Cr.	185	F(3)	12,000	0.75
Crooksville	Impounded	-	FD	2,300	0.10
New Concord	Crooked Creek (4)	-	D	1,000	0.08
Massillon	Wells & Newman Cr.	-	ILD	26,600	1.50
Barberton	Impounded	-	FD	24,000	1.50
Total - Below Sewer Outfalls				74,500	8.05
Total - Other				65,900	3.93
Total - Surface Water Supplies				140,400	11.98

(1) Miles above mouth of Muskingum River.
(2) I - Iron Removal, L - Lime - Soda softened, F - Coagulated, settled, filtered, D - Chlorinated.
(3) Softening plant under construction.
(4) Infiltration gallery.

Table Mu-3 Muskingum River Basin - Sources of Pollution, Including Industrial Wastes, Expressed as Sewered Population Equivalent (B.O.D.).

Municipality	Stream	Miles Above Mouth of Muskingum R.	Population Connected to Sewers	Treatment	Sewered Population Equivalent (B.O.D.) Untreated	Sewered Population Equivalent (B.O.D.) Discharged
McConnellsville	Muskingum River	48	1,700	None	3,400	3,400
Zanesville	" "	75	30,000	"	36,300	36,300
Dresden	" "	92	800	"	81,000	81,000
Coshocton	" "	109	10,000	"	128,100	128,100
Newcomerstown	Tuscarawas River	132	4,000	"	4,000	4,000
New Philadelphia	" "	164	11,000	"	14,400	14,400
Dover	" "	168	9,000	"	11,000	11,000
Massillon	" "	198	28,000	Chemical	37,200	23,200
Barberton	" "	219	21,500	"	30,500	19,800
Newark	Licking River	105	29,000	None	42,000	42,000
Granville	Raccoon Creek	113	2,500	Secondary	2,500	400
Cambridge	Crooked Creek	154	12,000	None	12,000	12,000
Wooster	Killbuck Creek	169	10,200	Chemical	10,200	5,100
Mt. Vernon	Kokosing River	160	9,500	Primary	9,700	6,300
Ashland	Jerome Fork	183	12,000	Secondary	12,100	1,900
Mansfield	Rocky Fork	187	40,500	Secondary	42,900	4,900
Shelby	Black Fork	225	6,000	"	6,000	900
Dennison	Little Stillwater Cr	159	4,300	None	4,300	4,300
Uhrichsville	Stillwater Creek	160	6,200	"	6,200	6,200
Canton	Nimishillen Creek	203	119,000	Secondary	161,300	29,500
Louisville	E.Br.Nimishillen Cr.	211	3,300	"	3,300	400
Minerva	Sandy Creek	209	2,700	Primary	2,700	1,800
Marshallville	Red Run	220	100	None	6,000	6,000
Rittman	River Styx	221	2,800	Secondary	18,000	15,600
Wadsworth	Blockers Creek	224	6,200	"	6,200	1,000
Orrville	Little Chippewa Cr.	231	4,500	"	10,100	1,500
Chippewa Lake	Chippewa Creek	232	2,500	"	2,500	400
63 smaller sources			33,300	(1)	39,300	30,800
Total			422,600		743,200	492,200

(1) Eight places have primary [illegible]



A

OHIO RIVER POLLUTION SURVEY
U.S. PUBLIC HEALTH SERVICE
1941

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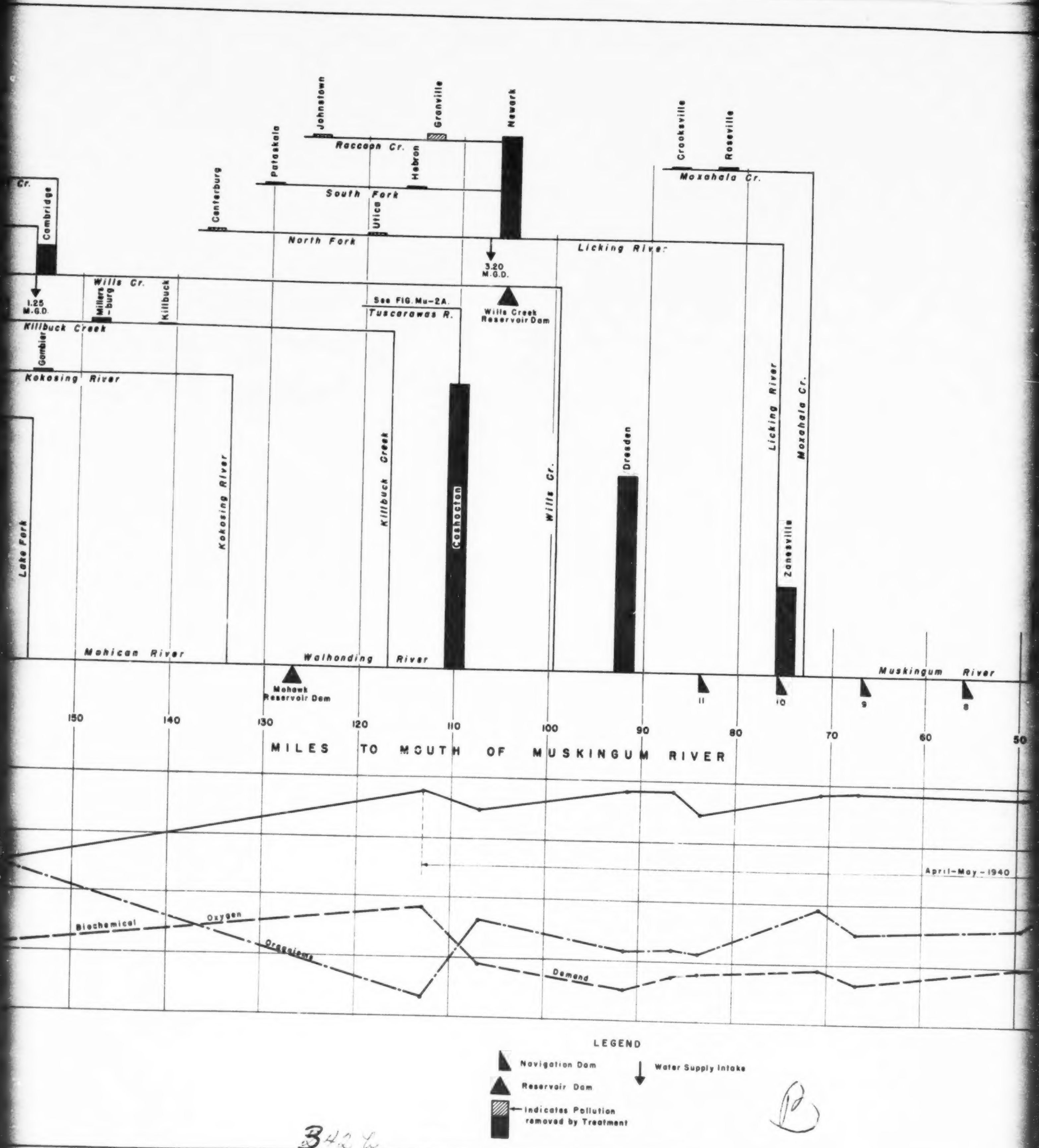
Johnstown
Granville
Newark
Raccoon Cr.
Pataskala
Hebron
South Fork
Crooksville
Roseville
Moxahala Cr.
Cr.
Cambridge
Canterburg
Utica
North Fork
Licking River
3.20
M.G.D.
1.25
M.G.D.
Wills Cr.
Millers-burg
Killbuck
Wills Creek Reservoir Dam
See FIG. Mu-2A.
Tuscarawas R.
Killbuck Creek
Gambier
Kokosing River
Licking River
Moxahala Cr.
Dresden
Wills Cr.
Killbuck Creek
Coshocton
Kokosing River
Lake Fork
Zanesville
Mohican River
Walhonding River
Muskingum River
Mohawk Reservoir Dam
11
10
9
8
150
140
130
120
110
100
90
80
70
60
50
MILES TO MOUTH OF MUSKINGUM RIVER
April-May-1940
Biochemical Oxygen Demand
Organisms
LEGEND
Navigation Dam
Water Supply Intake
Reservoir Dam
Indicates Pollution removed by Treatment

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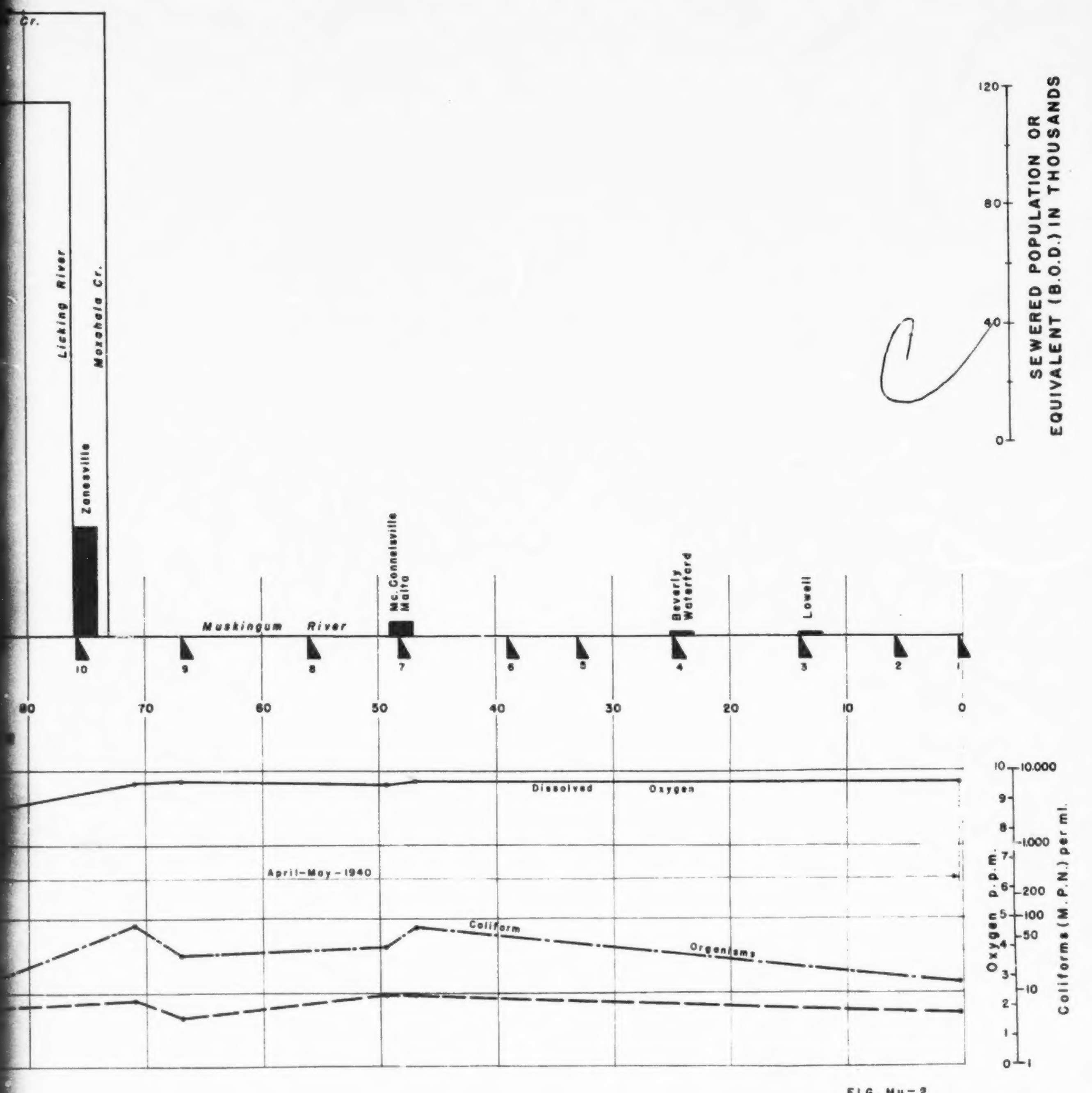
B



C

FIG. Mu-2

MUSKINGUM RIVER

SOURCES OF POLLUTION
AND
SELECTED LABORATORY DATA

B

FIG. Mu-2e

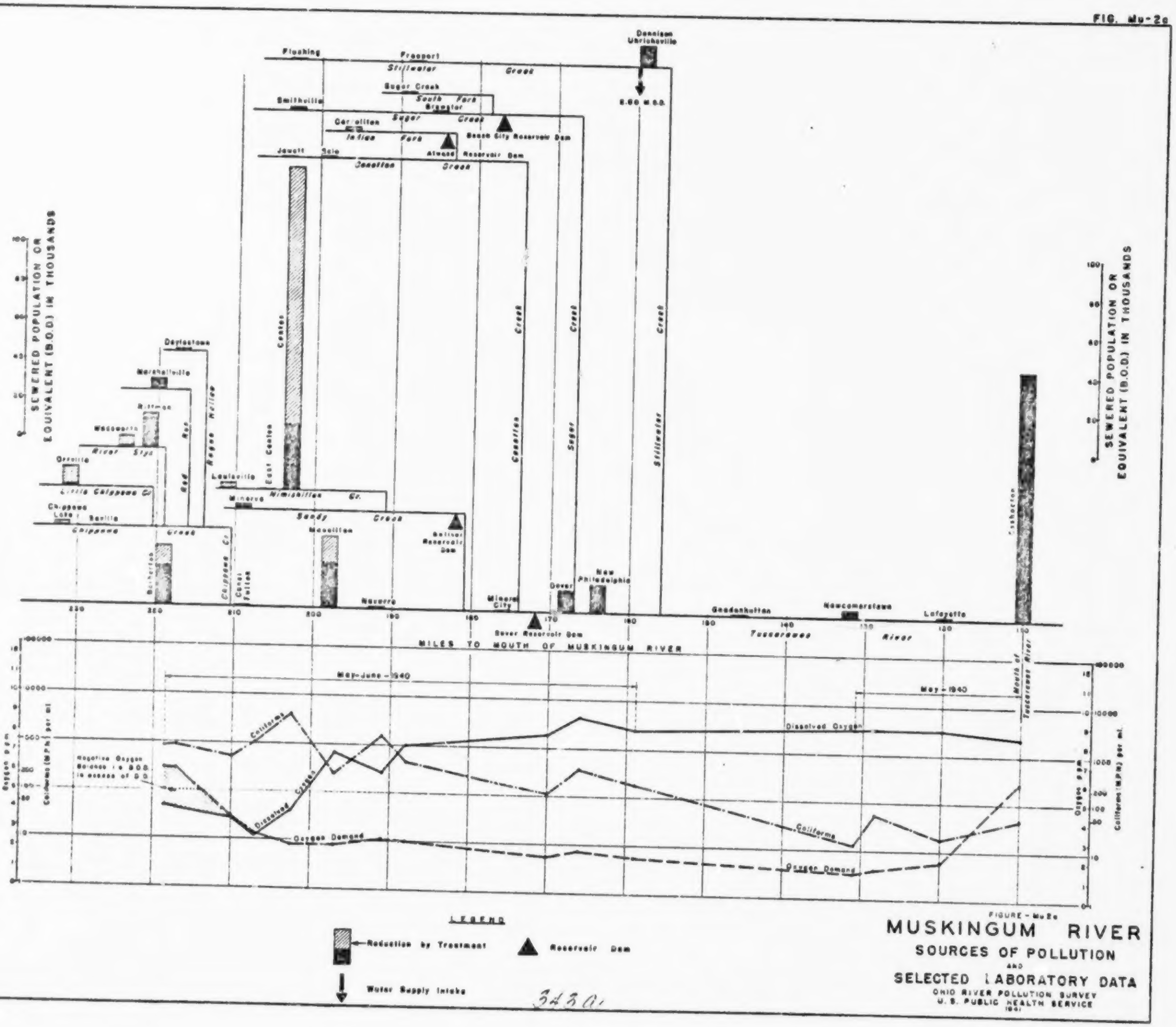


FIGURE – Mu 2e

MUSKINGUM RIVER

SOURCES OF POLLUTION
AND
SELECTED LABORATORY DATA

OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941

343a

Table Mu-4 Muskingum River Basin - Summary of Industrial Wastes not Discharged to Municipal Treatment Plants with Total of Entire Industrial Waste Load in the Basin.

Industry	Number of Plants	Industrial Waste Disposal		At Least Minor Corrective Measures Taken	Estimated Sewered Population Equivalent (B.O.D.)
		Munic. Sewers	Private Outlet		
Brewing	3	3	-	3	7,100
By-Product Coke	2	-	2	2	14,200
Meat	8	1	7	7	17,500
Milk	28	-	28	24	6,300
Oil Refining	2	-	2	2	11,400
Paper	4	-	4	2	210,000
Steel	11	1	10	5	-
Miscellaneous	26	10	16	11	14,000
Wastes Unconnected Munic. Treatment	84	15	69	56	280,500
Wastes Connected to Municipal Treatment					40,100
Total Industrial Waste in Basin					320,600

Acid Mine Drainage - Moxahala Creek is the largest acid stream in the basin. Some of the small streams in the eastern part of the basin also are acid. The mine sealing program has reduced the amount of acid entering the streams of the Muskingum and Hocking Basins from about 215,000 tons per year to about 125,000 tons per year. Most of the abandoned mines have been sealed.

Presentation of Laboratory Data

The results of the dissolved oxygen and B.O.D. tests in the Muskingum River Basin showed generally good conditions at the time of sampling. Average dissolved oxygen contents were usually over 6.5 p.p.m. and 5-day B.O.D. generally less than 3.0 p.p.m. Coliform organisms were high, averaging over 100 per ml. throughout most of the basin.

Summaries of the laboratory data are presented in Table Mu-7 and selected data on the main stream and its tributaries are shown in Table Mu-5. Observations were made at the mobile laboratory during April, May and June, 1940, supplemented by observations from the laboratory boat Kiski in May to September, 1940 in the lower end of the basin. Figures Mu-3, Mu-4 and Mu-5 show the average coliform, dissolved oxygen and B.O.D. results at various stations. Where observations at any point extended over more than thirty days, the most unfavorable monthly average is shown.

Average dissolved oxygen results of 5.0 p.p.m. or less were found only below Canton and Mansfield and along the Tuscarawas River from Barberton to Massillon. High B.O.D.'s were observed below Barberton, Rittman, Canton, East Sparta and Mansfield. Coliform averages of over 100 per ml. prevailed throughout the basin at the time of sampling except along the main extremities of the Licking River and Wills Creek.

Moxahala Creek was found to be acid with pH values of 2.5 to 4.0 and phenolphthalein acidities as high as 290 parts per million.

Throughout most of the basin the alkalinity of the stream waters averaged between 100 and 200 p.p.m., and the hardness was generally in the same range although below Barberton hardnesses of several thousand parts per million were found.

Stream flows were generally high during the time of the laboratory survey except in August and September. These stream flow conditions undoubtedly tend to make the dissolved oxygen and B.O.D. results appear more favorable, and the coliform results more unfavorable than would have been the case had the laboratory observations been made during the low flow and high temperature months.

Biological Summary - The plankton volume of the entire watershed is fairly high, ranging from 1,000 to 10,000 p.p.m. in the main stream to somewhat less in the principal tributaries. The streams support a good mixed fish population.

Table Mu-5 Muskingum River Basin - Selected Laboratory Data

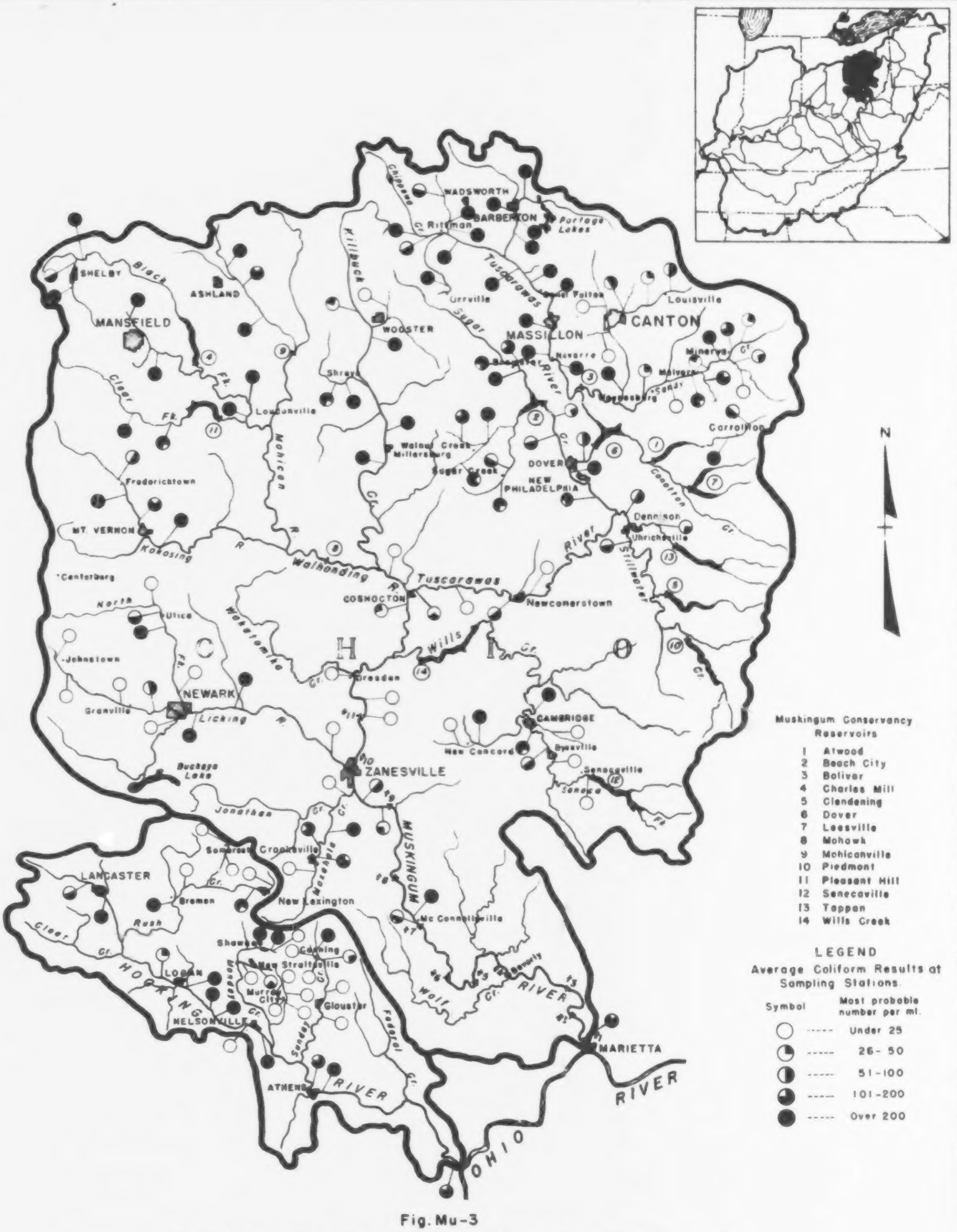
River Location	Muskingum at Marietta	Muskingum below McConnellsville	Muskingum below Zanesville	Muskingum below Dresden	Muskingum below Coshocton	Tuscarawas at Coshocton	Tuscarawas below Newcomerstown
River Miles Above: Mouth of Muskingum	0.2	47	71	86.5	107	110	128.5
Period - 1940	Aug.	Aug.	May	April-May	May	May	May
Number of Samples	11	4	3	3	2	3	3
Flow in c.f.s.:							
Sampling Days	2,050	3,140	6,117	17,433	3,215	1,520	1,430
Minimum Month	-	494	-	483	-	-	227
Water Temperature °C.	26.4	24.9	15.0	12.5	17.3	16.7	17.8
Hardness p.p.m.	-	-	-	104	256	350	244
Coliforms per ml.	13	85	89	16	43	43	53
Dissolved oxygen ppm.	7.5	7.5	9.5	9.8	8.8	8.4	8.8
B.O.D., 5-day p.p.m.	2.0	2.6	2.2	1.8	2.1	6.1	1.5

River Location	Tuscarawas below	above	Tuscarawas above Dover	Tuscarawas above Navarre	Tuscarawas above Massillon	Tuscarawas below Barberton	Tuscarawas above Barberton
	New Philadelphia						
River Miles Above: Mouth of Muskingum	159	166	170	191	202.5	217	223
Period - 1940	May-June	May-June	May-June	May-June	May-June	May-June	May-June
Number of Samples	3	3	3	3	3	3	3
Flow in c.f.s.:							
Sampling Days	2,395	2,395	2,073	618	569	259	259
Minimum Month	-	-	181	-	-	-	-
Water Temperature °C.	18.8	19.2	18.3	18.8	17.7	24.3	22.8
Hardness p.p.m.	275	-	-	-	-	1,450	-
Coliforms per ml.	191	389	114	1,480	4,050	889	380
Dissolved oxygen ppm.	8.5	9.1	8.2	6.1	4.0	4.1	6.8
B.O.D.,5-day p.p.m.	1.9	2.2	1.9	2.6	2.3	6.2	3.2

River Location	River Styx below Wadsworth	Chippewa Creek below Rittman	L.Chippewa Creek below Orrville	Nimishillen Creek below Canton	Stillwater Creek above Dennison	below Uhrichsville	Rocky Fork below Mansfield
River Miles Above: Mouth of Muskingum	221	217.5	229.5	193	165	156.5	184
Period - 1940	July	May-June	May-June	May-June	May-June	May-June	June
Number of Samples	1	3	3	3	3	3	3
Flow in c.f.s.:							
Sampling Days	31	29	2	129	657	894	51
Minimum Month	-	-	-	27.4	-	0	10.6
Water Temperature °C.	18.0	20.8	20.2	20.2	19.5	19.5	20.8
Coliforms per ml.	240	8,220	8,970	6,650	96	70	15,700
Dissolved oxygen ppm.	7.7	3.6	4.7	3.5	7.9	7.6	5.0
B.O.D.,5-day,p.p.m.	7.6	10.5	7.4	11.2	1.2	1.6	11.7

River Location	Jerome Fork below Ashland	Kokosing River below Mt.Vernon	Killbuck Creek below Wooster	Wills Creek above	below	N. Fork Licking above Newark	Licking below Newark
				Cambridge			
River Miles Above: Mouth of Muskingum	180.5	155.5	165	156.5	149	107.5	101
Period - 1940	June	June	May-June	May	May	April-May	April-May
Number of Samples	2	3	3	3	3	2	3
Flow in c.f.s.:							
Sampling Days	54	628	390	387	473	38	373
Minimum Month	-	-	-	-	18.1	-	-
Water Temperature °C.	19.5	20.8	18.8	15.3	16.0	13.5	11.0
Coliforms per ml.	161	337	853	103	551	4	313
Dissolved oxygen ppm.	4.2	7.2	6.3	7.5	6.4	10.6	9.2
B.O.D.,5-day p.p.m.	1.4	2.2	2.4	2.3	3.0	2.3	2.1

Fig. Mu-3



N
SHELBY
ASHLAND
MANSFIELD
WOOSTER
WADSWORTH
BARBERTON
Rittman
Portage Lakes
Orrville
MASSILLON
CANTON
Louisville
Minerva
Malvern
Carrollton
Loudonville
Shreve
Millersburg
Sugar Creek
DOVER
NEW PHILADELPHIA
Dennison
Uhrichsville
Fredericktown
MT. VERNON
Centerburg
Utica
Johnstown
NEWARK
Granville
Buckeye Lake
COSHOCTON
Newcomerstown
Dresden
ZANESVILLE
CAMBRIDGE
New Concord
Byesville
Senecaville
Somerset
Crooksville
LANCASTER
Bremen
New Lexington
Shawnee
Corning
New Straitsville
Murray City
Glouster
LOGAN
NELSONVILLE
ATHENS
Mc Connelsville
MARIETTA
Black Fk.
Clear Fk.
Kokosing R.
Mohican R.
Killbuck Cr.
Chippewa Cr.
Tuscarawas River
Sugar Cr.
Sandy Cr.
Conotton Cr.
Stillwater Cr.
Walhonding R.
Wakatomika Cr.
Wills Cr.
Licking R.
Jonathan Cr.
Moxahala Cr.
MUSKINGUM RIVER
Wolf Cr.
Meigs Cr.
Rush Cr.
HOCKING RIVER
Sunday Cr.
Federal Cr.
OHIO RIVER
O H I O
Muskingum Conservancy Reservoirs
1 Atwood
2 Beach City
3 Bolivar
4 Charles Mill
5 Clendening
6 Dover
7 Leesville
8 Mohawk
9 Mohicanville
10 Piedmont
11 Pleasant Hill
12 Senecaville
13 Tappan
14 Wills Creek
LEGEND
Average Coliform Results at Sampling Stations
Symbol — Most probable number per ml.
○ ----- Under 25
◔ ----- 26- 50
◑ ----- 51-100
◕ ----- 101-200
● ----- Over 200

Fig. Mu-3

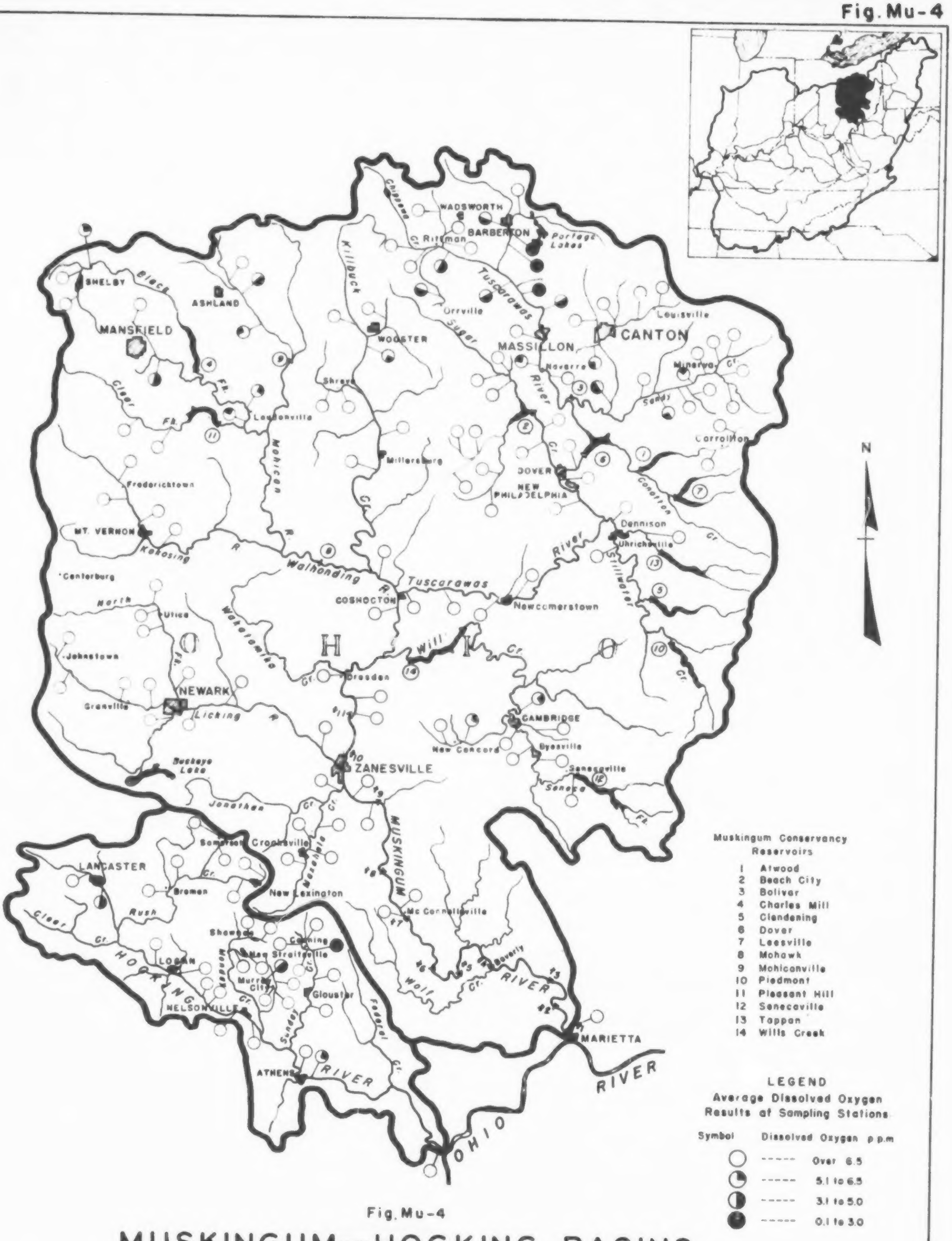
MUSKINGUM—HOCKING BASINS

COLIFORM RESULTS

10 0 10 20
SCALE OF MILES

OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941

Fig. Mu-4


SHELBY
Black
ASHLAND
MANSFIELD
Clear
Fk.
Loudonville
Fredericktown
MT. VERNON
Kokosing
Centerburg
North
Utica
Johnstown
Fk.
NEWARK
Granville
Licking
R.
Buckeye Lake
Wadsworth
Chippewa
Cr.
Killbuck
Rittman
BARBERTON
Portage Lakes
Tuscarawas
Orrville
Sugar
WOOSTER
Shreve
Mohican
R.
Millersburg
Cr.
MASSILLON
CANTON
Louisville
Navarre
Minerva
Sandy
Cr.
River
Carrollton
DOVER
NEW PHILADELPHIA
Conotton
Cr.
Dennison
Uhrichsville
Stillwater
Walhonding
R.
Tuscarawas
River
COSHOCTON
Newcomerstown
Wakatomika
Cr.
O
H
I
O
Wills
Cr.
Dresden
CAMBRIDGE
New Concord
Byesville
Senecaville
Seneca
Fk.
ZANESVILLE
Jonathan
Cr.
MUSKINGUM
Somerset
Crooksville
Moxahala
LANCASTER
Rush
Cr.
Bremen
New Lexington
Clear
Cr.
HOCKING
LOGAN
Monday
Shawnee
Corning
New Straitsville
Murray City
Glouster
NELSONVILLE
Sunday
Cr.
Federal
Cr.
ATHENS
RIVER
Mc Connelsville
Wolf
Cr.
Beverly
RIVER
MARIETTA
OHIO
RIVER
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1
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14
Muskingum Conservancy Reservoirs
1 Atwood
2 Beach City
3 Bolivar
4 Charles Mill
5 Clendening
6 Dover
7 Leesville
8 Mohawk
9 Mohicanville
10 Piedmont
11 Pleasant Hill
12 Senecaville
13 Tappan
14 Wills Creek
LEGEND
Average Dissolved Oxygen Results at Sampling Stations
Symbol
Dissolved Oxygen p.p.m.
○ ----- Over 6.5
◔ ----- 5.1 to 6.5
◑ ----- 3.1 to 5.0
● ----- 0.1 to 3.0

Fig. Mu-4

MUSKINGUM—HOCKING BASINS

DISSOLVED OXYGEN RESULTS

10 0 10 20
SCALE OF MILES

OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941

Fig. Mu-5

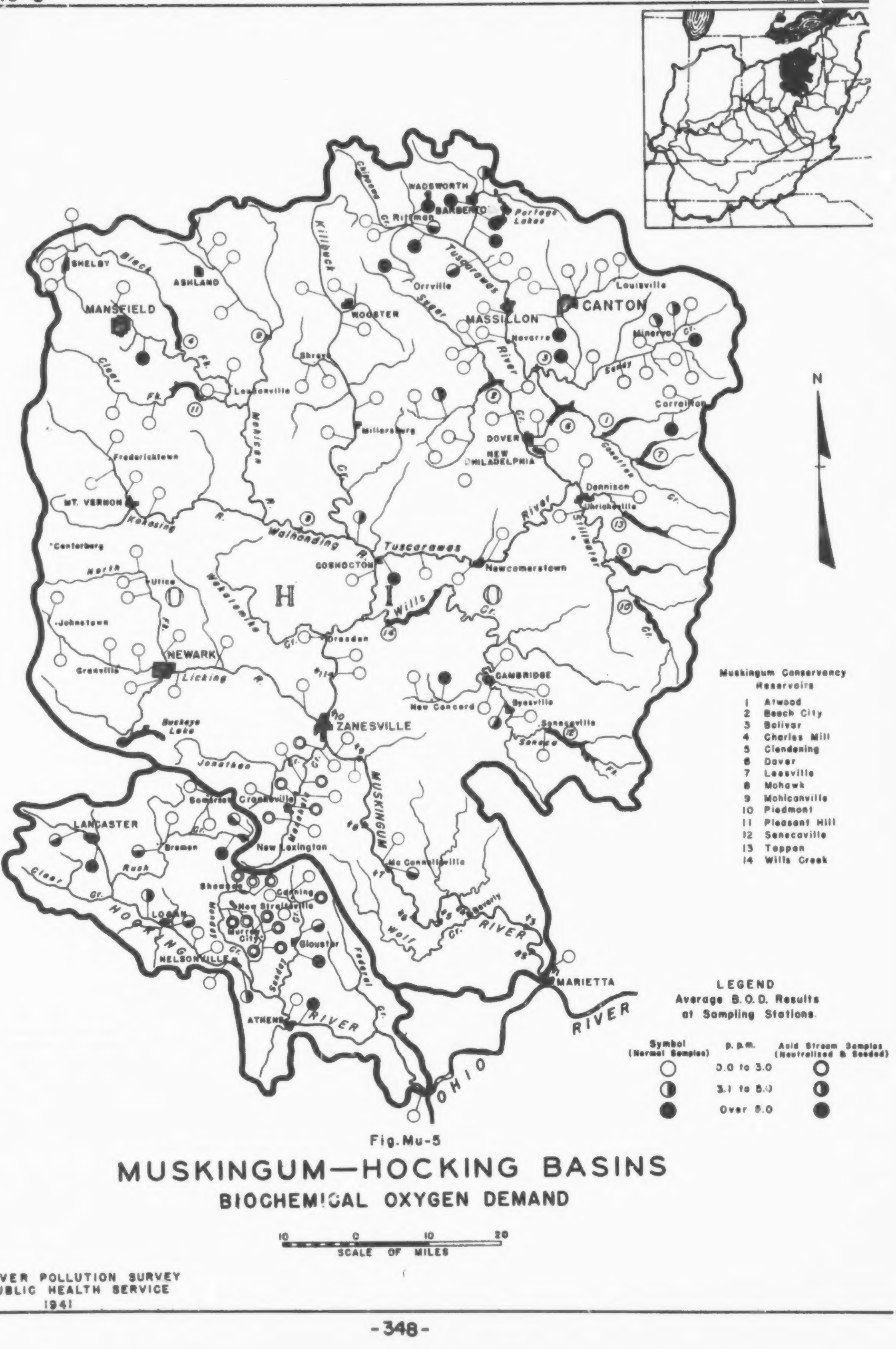
SHELBY
ASHLAND
MANSFIELD
WADSWORTH
BARBERTON
Rittman
Portage Lakes
Orrville
WOOSTER
MASSILLON
CANTON
Louisville
Navarre
Minerva
Carrollton
Loudonville
Shreve
Millersburg
DOVER
NEW PHILADELPHIA
Dennison
Uhrichsville
Fredericktown
MT. VERNON
Centerburg
Utica
Johnstown
COSHOCTON
Newcomerstown
NEWARK
Granville
Dresden
CAMBRIDGE
New Concord
Byesville
Senecaville
ZANESVILLE
Buckeye Lake
LANCASTER
Somerset
Crooksville
Bremen
New Lexington
Shawnee
Corning
New Straitsville
Murray City
LOGAN
NELSONVILLE
Glouster
ATHENS
McConnelsville
Beverly
MARIETTA
O H I O
Black Fk.
Clear Fk.
Mohican R.
Killbuck Cr.
Chippewa Cr.
Tuscarawas
Sugar Cr.
Sandy Cr.
Conotton Cr.
Stillwater Cr.
Kokosing R.
North Fk.
Walhonding R.
Wakatomika Cr.
Wills Cr.
Licking R.
Jonathan Cr.
Moxahala Cr.
Rush Cr.
Clear Cr.
Monday Cr.
Sunday Cr.
Federal Cr.
Wolf Cr.
Seneca Fk.
MUSKINGUM RIVER
HOCKING RIVER
OHIO RIVER
N
Muskingum Conservancy Reservoirs
1 Atwood
2 Beach City
3 Bolivar
4 Charles Mill
5 Clendening
6 Dover
7 Leesville
8 Mohawk
9 Mohicanville
10 Piedmont
11 Pleasant Hill
12 Senecaville
13 Tappan
14 Wills Creek
LEGEND
Average B.O.D. Results at Sampling Stations.
Symbol (Normal Samples)
p.p.m.
Acid Stream Samples (Neutralized & Seeded)
○ 0.0 to 3.0 ○
◐ 3.1 to 5.0 ◐
● Over 5.0 ●

Fig. Mu-5

MUSKINGUM—HOCKING BASINS

BIOCHEMICAL OXYGEN DEMAND

10 0 10 20
SCALE OF MILES

OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941

Hydrometric Data

Forty stream gaging stations have been maintained in the Muskingum River Basin for varying lengths of time and 34 of them are currently in operation. Many of these have been established recently in connection with the activities of the Muskingum Conservancy District. Table Mu-6 shows mean monthly summer flows during some of the low-flow years at eight selected stations.

Proposed Stream Control - Three reservoir sites, in addition to the 14 already used, have been studied by the U. S. Engineer Department in connection with the authorized program for flood control on the Ohio River and its tributaries. These sites are on Killbuck Creek, Wakatomika Creek and the Licking River. The existing reservoirs are not being used at present for low-flow regulation. At those reservoirs with conservation pools, regulation is limited to the maintenance of conditions approximating those that prevailed before the construction of the dams. At those without conservation pools, passage of low flows is unimpeded. The reservoirs could be used for low-flow regulation but the feasibility of such use is doubtful in view of existing recreational facilities which might be damaged by attendant fluctuations in reservoir levels.

Table Mu-6 Muskingum River Basin - Monthly Mean Summer Flows for Years in Which Low Summer Flows have Occurred.

River Location	Tuscarawas River near Dover	Muskingum River at Dresden	Nimishillen Creek at N. Industry	Stillwater Creek at Uhrichsville
River Miles Above: Mouth of Muskingum	169	91	199	160
Drain.Area Sq.Mi.	1,398	5,982	175	367
Period of Record	1924-39	1922-39	1922-39	1922-39
Year	1932	1930	1932	1930
June c.f.s.	357	1,330	44.9	14.2
July "	486	717	52.0	4.6
August "	258	483	28.0	0
September "	188	544	30.0	0
Year	1930	1932	1930	1939
June "	409	1,180	55.8	274
July "	251	1,600	31.4	152
August "	204	776	37.5	69.6
September "	217	550	33.7	5.0
Year	1939	1939	1934	1932
June "	789	3,581	63.5	31.2
July "	648	2,876	40.5	42.2
August "	374	1,622	68.3	20.8
September "	232	682	90.9	5.2

River Location	Kokosing River at Millwood	Killbuck Cr. at Killbuck	Wills Creek at Birds Run	Licking R. at Toboso
River Miles Above: Mouth of Muskingum	143	141	127	93
Drain. Area Sq.Mi.	472	466	730	672
Period of Record	1922-29	(1) 1924-39	1928-38	1922-39
Year	1930	1932	1930	1930
June c.f.s.	102	79.1	27.1	96.0
July "	57.7	108	9.9	59.8
August "	46.4	34.7	55.5	51.6
September "	58.9	34.8	9.8	53.8
Year	1932	1930	1932	1932
June "	99.0	106	55.4	138
July "	82.5	52.8	142	265
August "	48.9	35.6	75.7	70.3
September "	46.9	39.1	24.2	62.7
Year	1934	1939	1936	1925
June "	89.8	228	29.3	139
July "	88.9	126	56.1	223
August "	89.0	71.7	93.2	120
September "	48.4	42.9	58.4	63.0

(1) From 1924 to 1930 station was at Layland, seven miles downstream, drainage area 507 square miles.

Fig. Mu-6

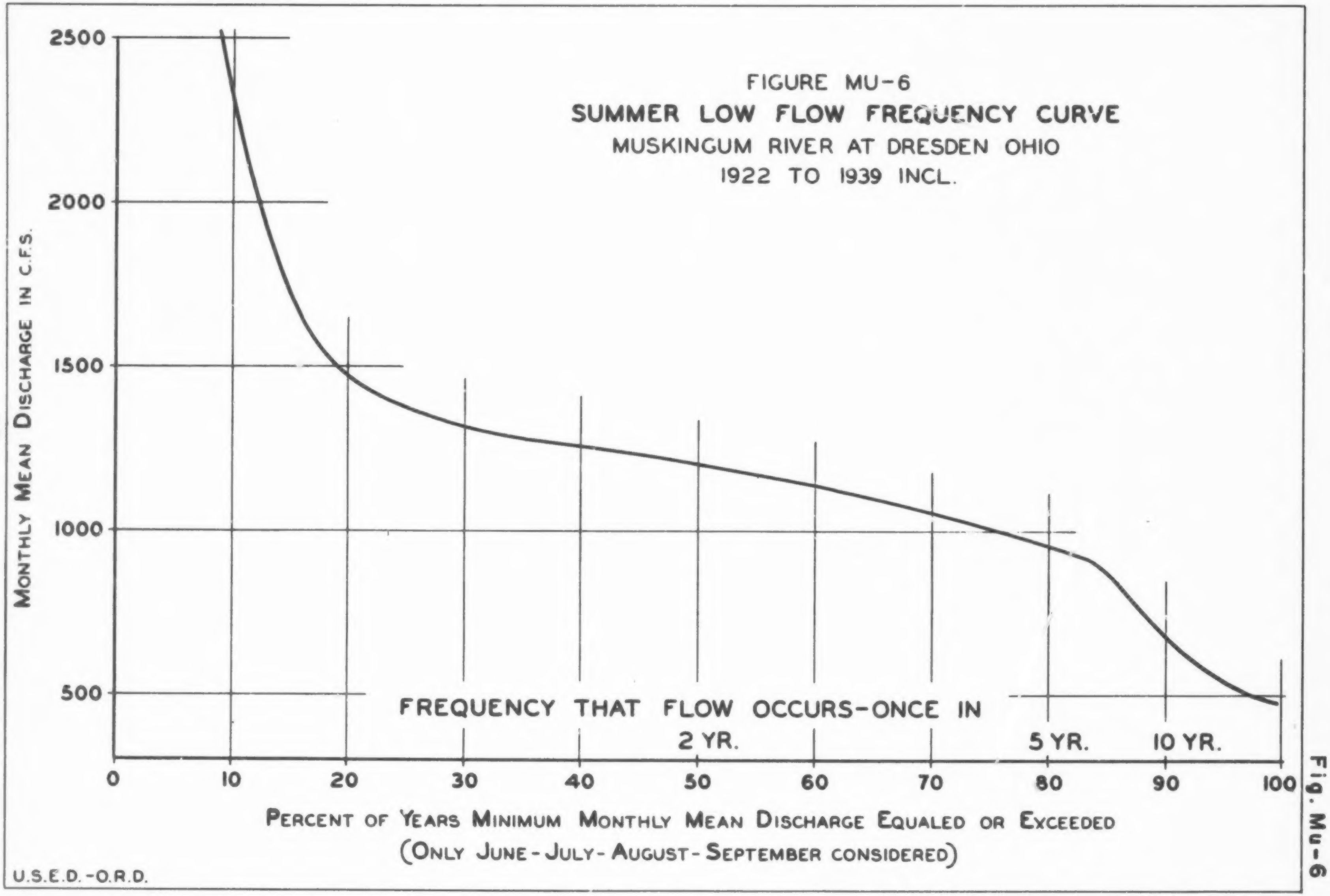

FIGURE MU-6

SUMMER LOW FLOW FREQUENCY CURVE

MUSKINGUM RIVER AT DRESDEN OHIO

1922 TO 1939 INCL.

Discussion

In general, the streams of the basin, except some of those in the densely populated northeastern part of the basin and a few receiving acid mine drainage, can be restored to relatively high standards of water quality with available treatment methods at a cost which seems justified by the prospective benefits. In the northeastern section of the basin high standards of water quality cannot be achieved generally at economically justified costs with available methods of treatment. Lower standards of quality adequate to prevent serious nuisance seem practicable. Completion of the mine sealing program will effect further reductions in the acidity of the streams. The bulk of the acid load is from active mines which would not be affected until sealing activities are modified to bring acid from worked out sections of active mines under control.

Primary treatment is indicated at 23 places and secondary treatment at 20 places as well as improvements or additions to 10 existing plants.

Tuscarawas River - The greatest concentration of population and industry and the most heavily polluted streams are in the northeastern part of the basin where Canton, Massillon and Barberton are located. The larger communities in this area have sewage treatment plants but the residual pollution after treatment, together with the industrial waste load, grossly pollutes the rather small streams that drain the area. The alkali plant at Barberton has the most far-reaching pollutional effect of any industry in the basin. The waste salts discharged increase the hardness of the Tuscarawas River to several thousand p.p.m. in its upper reaches and make the river throughout its length so saline as to render it undesirable as a source of water supply.

A paper plant manufacturing paperboard is located at Rittman where the receiving stream is very small. In spite of intensive efforts to reduce pollution which have resulted in recirculation of over 80 percent of the wastes and almost 90 percent reduction in the B.O.D. loading, the receiving stream is still heavily polluted. Steps should be taken to reduce the waste load further, after which continued effort to develop more efficient pollution control measures is amply justified.

The Barberton and Massillon sewage treatment plants provide only partial treatment and although the quality of the

Tuscarawas River could be improved by more refined treatment, the additional expenditure does not seem economically justified until effective steps are taken to abate industrial pollution. Present water uses along the upper Tuscarawas do not demand very high standards of water quality.

At Canton the sewage treatment plant, though probably adequate to treat the municipal wastes, is bypassed frequently because of breakdowns in the long trunk sewer leading to the plant. Methods of insuring the continuous flow of wastes to the plant are being studied and corrective measures should be undertaken quickly. It may be found desirable to construct a new plant nearer the city.

At New Philadelphia, Dover, Dennison and Uhrichsville stream flows are higher and primary treatment of sewage and removal of settleable solids from industrial wastes should suffice to maintain satisfactory stream conditions.

Muskingum River - At the communities along the Muskingum, where sewage is being discharged untreated, stream flows are large enough to permit the disposal of wastes with only primary treatment. At Zanesville, Dresden and Coshocton primary treatment of sewage and removal of settleable solids from industrial wastes should be adequate.

Three of the four paper plants, which account for two-thirds of the oxygen demand load from industrial wastes, manufacture strawboard and are located on the Muskingum River at Coshocton and Dresden where stream flows are relatively large. Recirculation systems or other measures to eliminate the discharge of settleable solids should be sufficient to maintain a satisfactory standard of water quality.

Miscellaneous Pollution - In spite of the relatively new and complete sewage treatment plant at Mansfield, the receiving stream, Rocky Fork, a tributary of the Mohican River, is heavily polluted. General plans for the correction of the situation have been prepared involving additional sewers and increased plant capacity.

At Newark, on the Licking River, and Cambridge, on Wills Creek, secondary treatment is indicated. Plans and estimates have been prepared for a complete treatment plant at Newark. Secondary treatment is also indicated at certain small communities where wastes are discharged to streams which are practically dry during a considerable part of the year.

A large number of small cheese plants are located in the area drained by Sugar Creek and Killbuck Creek. Only a few of these are accessible to municipal sewers and a number of small industrial treatment plants will be required.

Low-flow Regulation - Cambridge, on Wills Creek, is the only community requiring secondary treatment located below one of the existing or proposed flood control reservoirs. The Senecaville reservoir, about 30 miles above Cambridge, has the largest conservation pool of any of the Muskingum Conservancy District Reservoirs. If the entire conservation capacity were used for low-flow control, it could provide a flow of 100 c.f.s. at the reservoir and somewhat more than that at Cambridge (see Table Mu-6) during the dryest year of record. Use of the entire conservation pool for flow regulation does not seem feasible in view of the recreational and other development which has taken place at the reservoir. These developments require a reasonably constant reservoir level during the summer season and operation for flow regulation would conflict with this requirement. The determination of how much, if any, of the conservation storage might justifiably be used for flow regulation will require an appraisal of the damages which would be caused by fluctuating the reservoir level during the low-flow season.

Table Mu-1 shows the estimated cost of the suggested pollution abatement program, of the work done to date, and of programs for primary and for complete treatment of all wastes.

TABLE Mu-7 MUSKINGUM RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml.	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
River Styx Above Wadsworth, Ohio	MuTStx 224	May 22	4	22.0	8.6	97.5	5.8	46	7.7		158	
" "	" "	June 3	13	16.0	7.4	74.6	0.5	9	7.2			
" "	" "	" 10	27	22.5	6.0	68.3	1.0	240	7.4			
River Styx 2½ miles west of Wadsworth, Ohio	MuTStX 223.5	July 12		18.5	7.1	75.0	1.4	46	7.5			
River Styx 1 miles below Wadsworth, Ohio	MuTStx 221	May 22	4	21.5	10.6	119.0	3.7	43	7.9	15	174	
" "	" "	June 3	13	16.5	7.6	76.8	0.5	23	7.2	27		180
" "	" "	" 10	27	21.5	6.4	71.7	2.0	1,100	7.3	53		164
" "	" "	July 12	31	18.0	7.7	80.9	7.6	240	7.6	16		176
River Styx ½ mile above Rittman, Ohio	MuTStx 220.5	May 22	4	21.0	11.9	132.1	4.0	1,100	7.9	17	168	290
Chippewa Cr. 2 miles below Creston, Ohio	MuTCh 223.5	May 28	15	16.5	8.9	90.5	1.7	240	7.5	23	127	220
" "	" "	June 5	14	22.5	8.4	95.8	1.8	240	7.5	22		204
" "	" "	" 10	54	25.5	6.7	80.7	2.1	460	7.5			
Chippewa Creek 1/8 mi. south of Rittman, Ohio	MuTCh 220.5	May 22	7	20.5	10.2	112.0	3.3	24	7.8		160	
" "	" "	June 3	26	16.0	7.4	74.7	0.5	93	7.5			
Chippewa Cr. 2 miles below Rittman, Ohio	MuTCh 217.5	May 22	7	23.5	0.0	00.0	24.7	24,000	7.2	32	182	310
" "	" "	June 3	26	16.0	5.9	59.4	2.1	230	7.3	38		200
" "	" "	" 10	54	23.0	4.8	55.1	4.6	430	7.6	73		196
Little Chippewa Creek ½ mile below Orrville, Ohio	MuTChl 229.5	May 28	1	18.0	5.3	55.9	15.0	11,000	7.2	58	148	256
" "	" "	June 5	1	23.5	6.4	74.1	4.7	15,000	7.4	25		184
" "	" "	" 10	4	19.0	2.4	25.5	2.6	910	6.5	47		152
Tuscarawas R. 1½ miles abv. Barberton, Ohio	MuT 223	May 22	50	22.0	5.8	65.1	7.3	1,100	8.4		240	
" "	" "	June 3	206	21.0	8.0	88.8	1.1	36	7.6			
" "	" "	" 10	521	25.5	6.8	81.3	1.2	4	7.4			
Wolf Creek 200ft. above mouth Below Barberton, Ohio	MuTWo 219	May 22	25	32.0	3.9	53.1	12.7	4	9.6	20	440	
" "	" "	June 3	60	20.0	7.2	78.1	21.2	24	8.8	45	122	1,160
" "	" "	June 10	76	25.0	5.7	67.4	10.5	460	7.3	65		620
" "	" "	July 12	20	25.5	3.3	39.9	9.1	240	7.6	28		1,900
Tuscarawas River ½ mile above sewage plant Barberton, Ohio	MuT 218.5	May 22	50	28.5	3.1	39.3	12.4	4	9.6		340	2,250
" "	" "	June 3	206	21.0	5.4	59.7	1.0	93	8.4		134	
" "	" "	" 10	521	25.5	4.2	50.5	5.3	2,400	7.8			
" "	" "	July 12	69	23.5	1.3	15.5	4.5	93	7.5			
Tuscarawas River 1 mile below sewage plant Barberton, Ohio	MuT 217	May 22	50	27.5	3.4	42.9	12.9	230	8.0	10	64	
" "	" "	June 3	206	20.0	5.5	60.0	1.5	36	8.0	33	156	1,600
" "	" "	" 10	521	25.5	3.5	41.9	4.0	2,400	7.7	42		1,300
" "	" "	July 12	69	23.0	0.5	5.3	6.9	930	7.4	21		5,800
Tuscarawas River 1 mile above Canal Fulton, Ohio	MuT 210	May 17	139	14.0	3.0	29.1	6.3	930	7.4		172	
" "	" "	" 20	131	19.0	4.4	47.4	2.5	230	7.6			
" "	" "	June 13	1,220	21.0	3.3	36.9	2.3	390	7.3			

TABLE Mu-7 MUSKINGUM RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c. f. s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B. O. D. p.p.m.	Coliforms M. P. N. Per ml.	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Tuscarawas River 2 miles below Canal Fulton, Ohio	MuT 207	May 17	139	12.5	2.2	20.4	3.0	1,500	7.4	12	126	
" "	" "	" 20	131	18.5	2.3	24.5	2.4	43	7.5			
" "	" "	June 13	1,220	21.5	3.7	41.8	3.0	1,500	7.5			
Tuscarawas R. 3 miles abv. Massillon, Ohio	MuT 202.5	May 17	159	12.5	4.0	37.5	2.5	11,000	7.5		156	
" "	" "	" 20	148	19.0	4.8	50.8	1.5	230	7.5			
" "	" "	June 13	1,400	21.5	3.3	37.4	2.9	930	7.5	275		
Tuscarawas R. ½ mile Above sewage plant Massillon, Ohio	MuT 197	May 17	173	11.5	6.8	61.7	2.6	280	7.5		158	
" "	" "	" 20	162	19.5	10.2	109.9	2.4	240	7.6			
" "	" "	June 13	1,520	22.5	4.2	48.5	1.8	230	7.3			330
Tuscarawas River City limits above Navarre, Ohio	MuT 191	May 17	173	12.0	5.9	54.4	2.1	930	7.3		136	
" "	" "	" 20	162	19.0	8.4	89.7	2.0	1,100	7.6			
" "	" "	June 12	1,520	25.5	3.9	46.9	3.9	2,400	7.3			
Tuscarawas River 2 mile below Navarre, Ohio	MuT 188	May 17	173	13.0	8.0	75.1	1.7	430	7.5	7	154	1,470
" "	" "	" 20	162	19.0	10.6	113.8	2.2	240	7.8	12		164
" "	" "	June 12	1,520	25.5	3.8	46.3	3.6	750	7.3	280		322
Clear Fk. of Sandy Cr. 1 mi. abv. Minerva, O.	MuTSaCl 210.5	June 11	37	25.0	7.6	90.6	0.9	43	7.2	35		72
Clear Fk. of Sandy Cr. 1/3 mi.abv.Minerva,O.	MuTSaCl 309.8	May 24	39	16.5	8.3	83.9	2.7	240	7.3	53	71	120
" "	" "	" 29	22	17.5	9.5	99.0	4.6	43	7.2	15	58	108
Still Fk. of Sandy Cr. 2 mi.abv.Minerva,Ohio	MuTSaS 211	June 6	33	26.0	7.9	96.2	1.0	15	7.2			64
" "	" "	" 11	18	24.5	6.3	74.8	1.1	23	7.2			
Still Fk. of Sandy Cr. 1 mi. abv.Minerva, Ohio	MuTSaS 210	May 29	35	17.0	8.7	89.5	8.6	43	7.1			
Sandy Creek ½ mile below disposal plant Minerva, Ohio	MuTSa 208	May 24	39	16.5	7.3	74.4	8.5	4,600	7.3	45	87	156
" "	" "	" 29	22	18.0	8.7	90.9	3.5	9,300	7.3	25		96
" "	" "	June 6	18	25.5	8.0	96.0	1.2	430	7.3	22		74
" "	" "	" 11	37	23.5	6.6	76.3	1.2	930	7.2	55		66
Sandy Creek 1½ miles above Malvern, Ohio	MuTSa 205.5	June 11	123	23.5	6.4	74.3	1.4	43	7.2			
Pipe Run 1 mile above Malvern, Ohio	MuTSaP 205.5	May 24	11	16.0	7.5	75.6	2.7	240	7.0		41	
" "	" "	June 11	10	23.0	6.8	78.3	0.9	36	7.2	23		62
Sandy Creek 3 miles below Malvern, Ohio	MuTSa 201	May 24	141	16.0	7.6	76.0	1.6	93	7.3	40	89	200
" "	" "	June 11	133	24.5	6.8	80.6	1.7	150	7.5	52		74
Sandy Creek City limits abv. Waynesburg, Ohio	MuTSa 201	May 24	330	15.5	7.5	74.4	0.7	24	7.2		105	
Sandy Cr. 2½ miles bel. Waynesburg, Ohio	MuTSa 197	May 24	364	14.5	8.3	81.0	1.7	43	6.9	37	48	232

TABLE Mu-7 MUSKINGUM RIVER BASIN

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SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c. f. s.	Temp. °C	Dissolved Oxygen p. p. m.	Dissolved Oxygen % Sat.	5 Day B. O. D. p. p. m.	Coliforms M. P. N. Per ml.	pH	Turbidity p. p. m.	Alkalinity p. p. m.	Hardness p. p. m.
Nimishillen Cr. E. Br. ½ mile above Louisville, Ohio	MuTNiE 211.5	May 21	1	19.0	9.6	102.6	2.5	93	7.6		152	
" "	" "	" 29	16	17.0	11.2	114.5	1.4	43	7.8			
" "	" "	June 6	13	23.0	9.0	104.3	0.6	43	7.6			
Nimishillen Cr. E. Br. 3 miles below Louisville, Ohio	MuTNiE 206.5	May 21	1	19.0	10.4	111.3	1.5	3	7.2	22	116	400
" "	" "	" 29	16	17.5	5.2	53.5	1.2	110	6.9	48		330
" "	" "	June 6	13	23.5	10.2	119.2	0.4	4	7.6	7		280
Nimishillen Cr. Mid. Br. 1 mi. abv. Canton, Ohio	MuTNiM 206.5	May 21	13	18.5	10.2	107.9	2.7	93	8.0	7	169	330
" "	" "	" 29	26	16.5	8.8	89.4	0.9	43	7.8	20		280
" "	" "	June 6	19	24.0	9.8	114.3	2.0	93	7.7	8		270
Nimishillen W. Br. 1½ miles above Canton, Ohio	MuTNiW 205.8	May 21	9	15.5	9.0	89.9	1.0	9	7.6	12	130	340
" "	" "	" 29	20	16.0	9.9	99.6	0.4	9	7.6	5		310
" "	" "	June 6	15	24.0	10.5	123.0	0.6	9	7.9	5		250
Saxon Run at mouth Canton, Ohio	MuTNiSx 202.4	May 21	9	24.5	6.4	76.2	14.7	2	7.0	42	196	450
" "	" "	" 29	32	20.0	5.6	60.7	22.0	15	6.7	150	115	440
" "	" "	June 6	24	23.5	6.1	71.4	4.7	46	7.3	13		340
Nimishillen Creek 7 miles below Canton East Sparta, Ohio	MuTNi 193	May 21	92	22.5	4.1	46.6	21.0	4,600	7.4	18	188	410
" "	" "	" 29	171	16.0	5.2	52.2	6.8	360	7.3	14		400
" "	" "	June 6	125	22.0	1.2	14.0	5.8	15,000	7.2	10		340
Indian Fork Creek 1 mile above Carrollton, Ohio	MuTCoI 198	May 24	13	15.5	8.3	82.7	4.9	240	7.1		58	
" "	" "	June 7	6	26.0	9.6	116.7	0.5	23	7.9			
" "	" "	" 11	12	22.0	7.4	84.1	0.6	3	7.4			
Indian Fork Creek 1 mile below Carrollton, Ohio	MuTCoI 195	May 24	20	15.5	6.3	62.8	14.9	2,400	7.1	160	57	112
" "	" "	June 7	8	25.5	10.9	131.2	1.7	36	8.6	6		76
" "	" "	" 11	18	22.5	6.9	78.4	1.7	430	7.4	14		78
Tuscarawas River 2 miles above Dover, Ohio	MuT 170	May 23	440	19.0	9.3	99.0	2.0	93	7.8		118	
" "	" "	" 31	4,620	14.0	8.4	80.8	2.2	210	7.2			
" "	" "	June 7	1,160	22.0	7.0	79.6	1.6	39	7.4			
Sugar Creek 1 mile abv. Brewster, Ohio	MuTSu 185	May 17	36	10.5	10.4	93.2	1.6	24	7.6	90	128	270
" "	" "	" 20	41	18.0	10.1	106.0	0.7	1	7.8			
" "	" "	June 13	362	27.5	4.1	51.7	2.3	460	7.0			
Elm Run 3/4 mile abv. Brewster, Ohio	MuTSuE 185	May 20	**	18.5	11.9	126.0	1.2	9	8.0	5	128	664
" "	" "	June 13	5	20.5	7.7	84.5	1.2	240	7.1	75		112
Sugar Creek 1 mile below Brewster, Ohio	MuTSu 183	May 17	36	10.5	10.0	89.0	1.7	93	7.6		131	
" "	" "	" 20	41	18.5	11.7	123.5	1.1	23	8.0	16		740
" "	" "	June 13	362	28.0	3.5	44.7	2.3	4,600	6.8	310		100

TABLE MU-7 MUSKINGUM RIVER BASIN

OHIO RIVER POLLUTION SURVEY
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SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Walnut Creek 3/4 mile north of Walnut Creek, Ohio	MuTSuSW 190	May 27	4	15.0	9.8	96.7	1.8	240	7.3		55	
" "	" "	June 4	1	20.5	8.8	97.5	1.2	75	7.4			
Goose Creek ½ mile north of Walnut Cr., Ohio	MuTSuSG 190	May 27	2	14.5	10.1	98.7	1.1	240	7.2	14	47	96
" "	" "	June 4	1	20.5	10.5	115.2	0.5	9	7.5	10		116
Walnut Creek 2½ miles bel. Walnut Cr., Ohio	MuTSwSW 187.5	May 27	7	15.0	9.6	94.9	0.8	430	7.2	22	49	100
" "	" "	June 4	2	21.0	8.6	95.3	7.8	91	7.2	29		108
South Fk. Sugar Creek 1 mile above Sugar Creek, Ohio	MuTSuS 191.5	May 27	11	18.0	8.9	93.6	3.7	240	7.0		37	
" "	" "	June 4	8	21.5	8.9	99.6	0.9	43	7.1	27	80	
" "	" "	" 12	11	25.5	7.4	89.0	2.3	75	7.2			
South Fk. Sugar Creek 3 miles below Sugar Creek, Ohio	MuTSuS 171.5	May 27	15	16.5	9.2	93.3	1.3	43	6.2	32	20	96
" "	" "	June 4	11	22.0	8.2	93.1	1.0	43	6.4	31		84
" "	" "	" 12	16	25.0	7.7	91.9	0.6	150	6.9	85		74
Sugar Creek ½ mile above Strasburg, Ohio	MuTSu 174.5	May 23	46	17.5	8.0	82.8	1.0	**	7.6		114	
" "	" "	" 31	301	14.5	8.5	83.0	0.7	110	7.5			
" "	" "	June 7	116	21.0	6.8	75.9	0.4	4	7.4			
Sugar Creek 1½ miles below Strasburg, Ohio	MuTSu 171.5	May 23	46	17.0	8.1	83.4	1.1	23	7.6	7	118	200
" "	" "	" 31	301	14.5	8.5	83.0	1.3	240	7.2	43		188
" "	" "	June 7	116	20.5	7.0	76.5	0.4	9	7.3	14		160
Tuscarawas River City limits above New Philadelphia, Ohio	MuT 166	May 23	486	20.0	10.7	116.8	2.3	23	7.9		89	
" "	" "	" 31	5,420	14.5	8.2	80.6	2.0	1,100	7.1			
" "	" "	June 7	1,280	23.0	8.4	96.8	1.5	43	7.4			
Tuscarawas River 3½ miles below New Philadelphia, Ohio	MuT 159	May 23	486	19.5	8.9	96.1	1.8	240	7.5	12	110	328
" "	" "	" 31	5,420	14.0	8.7	84.0	2.3	240	7.2	110		236
" "	" "	June 7	1,280	23.0	7.9	90.9	1.6	93	7.5	28		260
L. Stillwater Creek 7 miles above Dennison, Ohio	MuTLSti 163	May 23	274	19.5	9.4	101.5	2.0	2	7.4	32	44	100
" "	" "	" 31	138	14.0	8.4	81.0	1.9	110	7.1	29		96
" "	" "	June 7	297	24.0	7.5	88.3	2.3	23	7.3	17		86
B. Stillwater Creek 3 miles above Dennison, Ohio	MuTBSt 165	May 23	261	19.5	8.2	88.9	1.2	4	7.4		94	
" "	" "	" 31	1,330	14.0	8.4	80.7	1.1	240	7.2			
" "	" "	June 7	380	25.0	7.2	85.8	1.4	43	7.4			
Big Stillwater Creek 2 miles below Urichsville, Ohio	MuTBSt 156.5	May 23	535	20.5	7.9	87.0	1.5	23	7.2	26	64	112
" "	" "	" 31	1,470	14.5	8.2	79.8	1.7	93	7.0	95		132
" "	" "	June 7	677	23.5	6.6	76.9	1.6	93	6.9	28		98
Tuscarawas River City limits above Newcomerstown, Ohio	MuT 131	May 8	1,770	16.5	8.4	88.9	1.2	24	7.2		73	
" "	" "	" 14	1,320	20.0	9.1	99.5	1.5	4	7.5			
" "	" "	" 16	1,200	14.0	8.8	85.1	1.2	9	7.4			

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SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage from Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Tuscarawas River 1 mile below [illegible], Ohio	MuT 128.5	May 8	1,770	18.5	8.5	90.1	1.4	43	7.2	10	76	290
" "	" "	" 14	1,320	20.0	9.1	99.5	1.7	23	7.5	12		268
" "	" "	" 16	1,700	15.0	8.9	87.5	1.4	93	7.4			
Tuscarawas River 1 mile north of West Lafayette, Ohio	MuT 120	May 8	1,840	18.5	8.4	89.1	2.3	46	7.4		77	
" "	" "	" 14	1,370	20.0	9.2	100.7	2.0	4	7.6			
" "	" "	" 16	1,250	14.5	8.8	86.2	1.4	4	7.4			
Tuscarawas River 500' above Confluence with Walhonding River	MuT 110	May 8	1,880	17.5	8.3	85.9	5.0	43	7.5	32	75	
" "	" "	" 14	1,400	19.5	8.6	92.3	6.4	43	7.6			
" "	" "	" 16	1,280	13.0	8.3	78.6	6.9	43	7.5	22		350
Black Fork ½ mile above Shelby, Ohio	MuWaMoBl 206	June 18	2	24.0	8.2	95.8	1.0	43	7.8		188	
" "	" "	" 19	4	21.5	7.2	80.9	1.8	460	7.3			
" "	" "	" 20	2	16.0	7.6	76.9	0.5	460	7.5			
Black Fork 1 mile below Shelby, Ohio	MuWaMoBl 202.5	June 18	5	22.5	7.2	82.1	1.3	91	7.5	14	122	156
Black Fork 2½ miles below Shelby, Ohio	MuWaMoBl 201	June 19	12	20.5	5.4	59.7	3.1	2,400	7.1	390		120
" "	" "	" 20	7	15.5	6.6	65.5	1.6	4,600	7.2	53		180
Rocky Fork 1½ miles above Mansfield, Ohio	MuWaMoBlR 190	June 17	17	19.5	7.6	81.5	0.7	75	7.4		152	
" "	" "	" 18	23	22.0	7.0	79.7	2.6	460	7.6			
" "	" "	" 19	66	21.0	5.7	63.7	1.6	460	7.0			
Rocky Fork 2½ miles below Mansfield, Ohio	MuWaMoBlR 184	June 17	24	19.5	5.1	54.9	1.2	430	7.5	23	172	196
" "	" "	" 18	33	22.5	3.0	34.4	30.7	46,000	7.0	2,200		124
" "	" "	" 19	95	20.5	7.0	77.6	3.1	750	7.1	290		122
Black Fork West edge of Loudenville, Ohio	MuWaMoBl 163	June 14	471	23.5	6.0	69.3	2.6	23	7.5		111	
" "	" "	" 17	426	21.5	5.8	65.3	1.5	460	7.5			
" "	" "	" 20	459	19.0	6.4	68.4	2.0	460	7.5			
Black Fork 1½ miles bel. Loudenville, Ohio	MuWaMoBl 161	June 14	471	21.5	6.1	68.5	3.3	430	7.3	155	108	152
" "	" "	" 17	426	21.5	6.0	67.5	2.2	430	7.4	143		164
" "	" "	" 20	459	19.0	6.4	68.1	2.5	430	7.4	75		142
Clear Fork North City Limits Belleville, Ohio	MuWaMoCl 180	June 14	145	21.5	7.9	88.8	0.9	120	7.7	37	118	128
" "	" "	" 17	131	21.0	7.8	86.4	0.4	15	7.6			
" "	" "	" 19	366	21.0	7.1	79.3	1.8	1,100	7.5			
Clear Fork 3½ miles below Belleville, Ohio	MuWaMoCl 174.5	June 14	145	21.5	7.5	84.3	1.1	43	7.6		126	
" "	" "	" 17	131	21.0	7.6	84.9	0.3	9	7.6			152
" "	" "	" 19	366	21.0	5.3	58.7	2.5	460	7.5	360		110
Jerome Fork 1½ miles above Ashland, Ohio	MuWaMoJe 183	June 14	78	20.0	7.0	76.6	0.9	150	7.5		125	
" "	" "	" 18	33	21.5	7.3	81.6	1.0	43	7.6			
" "	" "	" 20	31	16.0	7.6	76.4	1.1	460	7.5			

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OHIO RIVER POLLUTION SURVEY
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Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliform M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
					p.p.m.	% Sat.						
Jerome Fork 2 miles east of Ashland, Ohio	MuWaMoJe 180.5	June 18	56	22.0	5.5	62.7	1.3	230	7.6	17		188
" "	" "	" 20	52	17.0	2.8	28.6	1.4	91	6.6	12		224
Jerome Fork 4 miles below Ashland, Ohio	MuWaMoJe 175	June 14	130	21.5	5.4	60.8	1.0	430	7.5	58	124	176
N. Br. Kokosing River ½ mile above Fredericktown, Ohio	MuWaKoN 161.5	June 17	55	20.5	8.2	90.0	0.5	4	7.8		190	
" "	" "	" 18	140	21.0	7.7	86.0	0.5	24	7.8			
" "	" "	" 19	178	21.0	7.0	78.3	1.4	240	7.5			
N. Br. Kokosing River 1 mile below Fredericktown, Ohio	MuWaKoN 166.5	June 17	55		7.9		0.8	93	7.8	13	162	180
" "	" "	" 18	140	21.0	7.4	82.8	0.9	93	7.8	30		
" "	" "	" 19	178	21.0	6.9	76.6	1.6	2,400	7.5			116
Kokosing River N. W. city limits Mt. Vernon, Ohio	MuWaKo 161.5	June 18	650	22.0	7.4	83.6	0.9	23	7.8		168	
" "	" "	" 19	825	21.5	6.7	75.5	3.5	240	7.5			
" "	" "	" 20	408	18.5	8.5	90.0	0.6	240	7.8			
Kokosing River 2 miles below Mt. Vernon, Ohio	MuWaKo 155.5	June 18	650	21.5	6.8	76.5	2.8	430	7.8	32	157	180
" "	" "	" 19	825	21.5	7.2	80.6	2.1	430	7.6	210		160
" "	" "	" 20	408	19.5	7.7	83.4	1.8	150	7.5	42		176
Killbuck Creek 1 mile above Wooster, Ohio	MuWaKi 169	May 28	103	15.0	8.9	87.5	1.0	24	7.4		109	
" "	" "	June 5	78	22.0	8.0	90.6	1.3	46	7.6			
Little Apple Creek 3/4 mile above Wooster, Ohio	MuWaKiLi [illegible]	May 28	4	13.5	10.4	99.4	1.1	4	7.8	6	116	140
" "	" "	June 5	2	21.0	9.4	104.2	0.9	24	8.0	3		116
" "	" "	" 12	11	22.5	7.9	90.2	1.3	24	7.4	38		96
Killbuck Creek 2½ miles below Wooster, Ohio	MuWaKi 165	May 28	160	15.0	7.4	73.0	2.2	430	7.5	43	115	148
" "	" "	June 5	120	20.0	5.8	62.9	2.7	1,200	7.5	32		140
" "	" "	" 12	890	21.5	5.8	65.0	2.3	930	7.3			
Shreve Cr. city limits above Shreve, Ohio	MuWaKiSh 163	May 28	4	17.0	9.6	99.1	1.2	240	7.9		201	
" "	" "	June 5	1	19.5	8.8	95.6	1.1	9	7.6			
" "	" "	" 12	30	22.0	4.9	55.8	1.9	110	7.3			
Shreve Creek ½ mile below Shreve, Ohio	MuWaKiSh 161.5	May 28	4	17.5	10.5	109.2	1.0	93	7.9	65	205	250
" "	" "	June 5	1	18.0	9.1	95.4	0.4	150	7.6	5		204
" "	" "	" 12	30	21.5	7.1	79.7	1.7	1,100	7.4	77		124
Killbuck Creek 3½ miles above Millersburg, Ohio	MuWaKi 153	May 27	484	17.5	8.0	83.3	1.2	240	7.5		126	148
" "	" "	June 4	348	20.5	7.0	77.2	1.7	230	7.6			
Killbuck Creek 2 miles below Millersburg, Ohio	MuWaKi 146	May 27	484	15.0	8.0	83.5	1.9	430	7.5	28	112	
" "	" "	June 4	348	20.5	7.2	78.7	0.8	230	7.6	25		156
" "	" "	" 12	2,070	24.5	5.6	66.4		930	7.3			102

TABLE Mu-7 MUSKINGUM RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml.	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
					p.p.m.	% Sat.						
Walhonding River 4 miles above Coshocton, Ohio	MuWa 113	May 8	1,750	17.0	9.0	92.2	2.3	2	7.8	40	113	
" "	" "	" 14	1,490	20.0	9.9	108.4	8.4	2	8.3			
" "	" "	" 16	1,260	14.0	9.3	89.7	2.3	2	8.0	10	123	200
Muskingum River 1 mile below Coshocton, Ohio	Mu 107	May 8	3,620	15.5	8.6	85.1	1.7		7.5	32	100	272
" "	" "	" 14	2,810	19.0	8.9	95.6	2.5	43	7.8	6		240
Seneca Fk. Wills Creek Senecaville Dam	MuWiS 181.5	May 7	108	19.5	11.0	118.8	1.7	2	7.8	20	83	
" "	" "	" 10		10.5	8.5	76.1	0.6	**	7.5	15	85	
" "	" "	" 13		14.0	9.5	91.4	0.7	**	7.6	22		132
Wills Creek ½ mile above Byesville, Ohio	MuWi 166.5	May 7	233	19.5	9.1	97.9	1.4	46	7.5	56	95	120
" "	" "	" 10	75	11.5	7.9	72.4	1.6	24	7.5		115	
" "	" "	" 13	64	15.5	9.0	89.1	2.1	2	7.6			
Wills Creek 1 mile below Byesville, Ohio	MuWi 162	May 10	75	13.0	8.0	75.8	3.3	9	7.5	42	117	144
" "	" "	" 13	4	15.5	8.5	84.6	1.4	9	7.4	27		176
" "	" "	" 14	867	20.5	6.3	69.7	5.1	240	7.0	750		100
Wills Creek Bridge U. S. 21 Cambridge, Ohio	MuWi 156.5	May 9	120	16.0	8.6	86.4	2.3	46	7.2		108	
" "	" "	" 15	625	16.5	6.2	63.5	2.9	240	7.3			
" "	" "	" 16	415	13.5	7.8	74.2	1.6	23	7.3			
Leatherwood Creek 2 miles above Cambridge, Ohio	MuWiL 162	May 7	25	21.5	11.6	130.2	0.9	2	8.3	35	84	
" "	" "	" 9	22	17.0	10.4	106.3	1.6	4	7.2			
" "	" "	" 10	20	15.5	10.0	99.9	1.2	4	7.9	22	104	192
Crooked Creek Water works intake above New Concord, Ohio	MuWiCr 165	May 7	3	18.0	10.6	111.0	0.9	**	7.6	17	115	160
" "	" "	" 8	3	15.5	7.7	76.3	1.1	3	7.5			
" "	" "	" 9	3	14.0	7.5	72.1	1.1	2	7.4	17		
Crooked Creek ½ mile below New Concord, Ohio	MuWiCr 162	May 8	4	15.5	7.1	70.3	1.4	93	7.3	13	114	148
" "	" "	" 9	3	14.0	6.8	65.3	1.7	93	7.5			140
" "	" "	" 13	2	14.0	4.5	43.3	13.9	460	7.4	20	118	152
Wills Creek ½ mile below Cambridge, Ohio	MuWi 149	May 9	140	17.5	7.2	74.8	2.8	460	7.2	45	106	140
" "	" "	" 15	770	16.5	5.8	59.3	4.1	1,100	7.1	550		96
" "	" "	" 16	510	14.0	6.2	60.0	2.0	93	7.2	55		170
Muskingum R. 1 mile east of Dresden, Ohio	Mu 91.5	Apr. 30	19,900	15.5	9.9	98.3	0.8	4	7.6		54	
" "	" "	May 1	19,400	14.5	9.6	94.1	1.4	4	7.2			
" "	" "	" 3	13,000	8.5	9.9	84.4	1.0	24	7.2	92		140
Muskingum River 5 miles below Dresden, Ohio	Mu 86.5	Apr. 30	19,900	15.0	9.8	96.4	2.8	36	7.6	115	53	108
" "	" "	May 1	19,400	14.5	9.6	93.8	0.2	4	7.2	80		100
" "	" "	" 3	13,000	8.0	9.9	83.7	2.5	9	7.2			

TABLE Mu-7 MUSKINGUM RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1950	Average Discharge c.f.s.	Temp °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Muskingum River L. Lock #11 - Above Zanesville, Ohio	Mu 83.9	May 9	5,200	14.5	8.3	81.0	1.8	4	7.5			
" "	" "	" 14	4,250	19.0	9.3	99.7	2.8	24	7.7			
" "	" "	" 16	4,550	14.0	8.2	78.9	3.9	12	7.5	14		230
N.Fk. Licking River 11 miles above Utica, Ohio	MuLN 130.5	Apr. 30	44	14.5	9.8	95.5	1.2	9	7.8		173	
" "	" "	May 2	39	9.0	10.9	94.2	1.2	2	7.8			
" "	" "	" 3	38	7.0	11.7	96.3	2.1	[illegible]	7.5			
N.Fk. Licking River Above Utica, Ohio	MuLN 119	Apr. 30	44	14.5	9.5	92.6	1.4	15	7.8		173	
" "	" "	May 2	39	9.5	10.7	93.4	1.0	110	7.8			
N.Fk. Licking River 2 miles below Utica, Ohio	MuLN 117	Apr. 30	44	15.0	9.6	95.1	1.7	430	7.7	10	174	224
" "	" "	May 2	39	8.5	10.5	89.3	2.1	460	7.8			
" "	" "	" 3	38	7.5	11.4	95.2	1.6	280	7.7			
N.Fk. Licking River Water works Intake Newark, Ohio	MuLN 107.5	May 3	43	9.0	10.6	91.0	3.4	8	7.7			
" "	" "	" 6	34	18.0	10.5	110.5	1.2	**	7.9			
Raccoon Creek 1½ miles above Johnstown, Ohio	MuLRa 126	Apr. 30	4	13.0	9.4	88.3	1.2	9	7.7		172	
" "	" "	May 1	4	12.5	10.7	100.2	1.7	4	7.9			
" "	" "	" 6	2	15.5	10.6	105.8	1.4	2	7.9			
Raccoon Creek 3½ miles below Johnstown, Ohio	MuLRa 122.5	Apr. 30	4	13.5	9.7	92.4	1.2	4	7.7		183	
" "	" "	May 1	4	12.5	10.4	97.1	1.0	2	7.9			
" "	" "	" 6	2	16.5	9.8	99.4	1.3	1	7.7			
Raccoon Cr. 1/8 mile above Granville, Ohio	MuLRa 114.5	Apr. 30	20	14.0	8.6	82.4	1.2	4	7.6		190	
" "	" "	May 1	20	13.0	9.1	85.6	1.5	4	7.6			
" "	" "	" 6	13	17.5	10.0	103.7	2.1	2	7.8	50		
Raccoon Creek 3 miles below Granville, Ohio	MuLRa 109	Apr. 30	20	13.0	9.5	89.5	2.6	150	7.7	10	190	190
" "	" "	May 1	20	14.0	10.1	97.4	2.1	43	7.9			204
" "	" "	" 6	13	17.0	11.3	116.2	3.1	43	8.0			244
S.Fk. Licking River ½ mile above Newark, Ohio	MuLS 107	May 2	85	10.5	9.4	83.9	2.8	4	7.7		178	
" "	" "	" 3	80	8.5	10.1	86.0	2.0	4	7.8			
Licking River 1 mile below Newark, Ohio	MuL 101	May 1	380	14.5	8.3	81.3	3.2	240	7.6	27		
" "	" "	" 2	390	9.5	9.3	80.8	1.3	240	7.6		191	
" "	" "	" 3	350	9.0	10.1	87.2	1.9	460	7.8			190
Licking R. 3½ miles below Newark, Ohio	MuL 97.5	May 1	530	14.5	8.1	79.0	2.8	240	7.6	18	196	280
" "	" "	" 2	510	8.5	9.3	79.4	2.3	240	7.6	19	187	280
" "	" "	" 3	500	9.0	10.1	87.1	1.8	460	7.8		13	

TABLE Mu-7 MUSKINGUM RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Licking River 2½ miles above Zanesville, Ohio	MuL 79.5	May 7	650	17.5	9.7	100.8	0.9	1	7.3		162	
" "	" "	" 9	520	14.0	9.6	92.2	0.8	24	7.8		100	
" "	" "	" 14	540	18.5	9.4	99.3	1.5	21	7.9			
Moxahala Creek ¼ mile above Crooksville, Ohio	MuMx 87.5	Apr. 16	322	10.0	10.8	95.1	0.5 3.0*	**	[illegible]			
" "	" "	" 18	521	12.0	9.8	90.1	2.6 1.4*	2	4.7			
" "	" "	" 24	167	6.0	10.7	90.1	2.6 1.3*	**	4.0			
Moxahala Cr. 1 mi. abv. Crooksville, Ohio	MuMx 88.0	May 27	67	16.0	9.0	90.3	1.2		3.0			
" "	" "	June 5	49	20.0	9.0	98.4	1.1		3.1	23		
" "	" "	" 14	57	22.0	8.0	90.7	0.2	1	3.3	28		
" "	" "	" 24	51	22.0	7.2	82.6	0.5 3.0*	11	3.3	105		
" "	" "	July 2	26	17.5	9.0	93.7	0.8 0.4*	**	3.1	32		
" "	" "	" 19	**	21.5	8.0	90.0	0.6 0.5*		2.8			
" "	" "	" 29	2	25.0	7.5	89.6	3.9 0.8*		2.8			
Moxahala Cr. 1 mile abv. Crooksville, Ohio	MuMx 88.0	Aug. 6	4	23.5	7.8	91.0	1.4 1.5*	**	2.9			
" "	" "	" 14	4	23.0	7.1	81.6	0.7 0.9*	**	2.7			
" "	" "	" 22	2	16.0	9.1	91.3	0.8 1.5*	**	2.7			
" "	" "	" 30	521	21.0	7.9	87.9	2.4 2.2*	29	2.8	320		
" "	" "	Sept. 9	6	18.5	9.4	99.9	0.0 1.1*	**	2.5			
" "	" "	1941 Jan. 21		2.0	13.4	97.2	1.1 1.1*	0	3.4	10		
Moxahala Cr. 1 mile below Crooksville, Ohio	MuMx 85	1940 Apr. 16	347	11.0	10.7	96.9	1.3 2.7*	12	4.4			86
" "	" "	" 18	626	12.5	9.8	91.9	2.0 2.7*	43	4.4			
" "	" "	" 24	180	8.5	11.0	93.8	3.1 2.0*	3	3.5			
" "	" "	May 27	72	16.0	8.2	82.5	1.3	4	3.0	25		
" "	" "	June 5	53	19.5	8.1	87.4	0.6		3.0	22		
" "	" "	" 14	62	21.5	7.6	85.3	1.6	**	3.1	10		
" "	" "	" 24	55	21.0	7.2	79.9	0.7 1.6*	**	3.0	45		
" "	" "	July 2	29	17.5	8.5	87.9	0.8 1.0*	2	3.0	11		
" "	" "	" 19	**	25.0	7.8	92.5	0.5 1.1*		2.8	6		
" "	" "	" 29	2	27.5	6.8	85.1	1.0 0.6*		2.8	7		
" "	" "	Aug. 6	4	23.5	7.1	82.2	0.9 1.8*	2	2.9			
" "	" "	" 14	5	23.0	6.5	75.4	1.6 1.4*		2.7			
" "	" "	" 22	2	17.0	7.7	79.3	1.8 1.4*		2.7			
" "	" "	" 30	570	21.0	7.6	85.1	2.6 3.2*	460	3.0	700		
" "	" "	Sept. 9	6	20.0	7.6	82.7	0.7 0.3*		2.5	5		
" "	" "	1941 Jan. 21		1.0	13.6	95.7	0.5*	**	3.4	30		
Moxahala Cr. 1 mile above Roseville, Ohio	MuMx 83.5	1940 Apr. 16	352	9.0	10.8	93.2	0.8 2.9*	1	4.2			
" "	" "	" 18	686	14.0	9.7	93.8	1.5 2.1*	2	4.5			
" "	" "	" 24	183	8.5	10.9	93.0	2.6	4	3.3			
" "	" "	May 27	73	16.0	8.6	86.4	0.5	4	3.0	34		
" "	" "	June 5	54	21.5	8.1	90.7	0.3		3.0	25		
" "	" "	" 14	63	22.5	7.9	90.5	0.3	**	3.2	16		
" "	" "	" 24	56	21.5	7.7	86.0	0.7 1.4*	**	3.0	53		
" "	" "	July 2	[illegible]	18.0	8.6	89.7	0.7 0.7*	**	3.0	16		
" "	" "	" 19	**	24.5	7.9	93.5	0.6 0.9*		2.9	26		

TABLE Mu-7 MUSKINGUM RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Moxahala Cr. 1 mile above Roseville, Ohio	MuMx 83.5	July 29	2	27.5	7.3	91.1	0.4 0.8*		2.8	12		
" "	" "	Aug. 6	4	23.5	7.5	86.9	0.0 1.2*	11	3.0	17		
" "	" "	" 14	5	24.0	7.1	83.2	0.8 1.2*		2.9	4		
" "	" "	" 22	2	18.0	8.4	88.1	1.8 2.0*	**	2.8	4		
" "	" "	" 30	588	20.5	7.6	83.1	2.0 1.5*	460	3.2	545		
" "	" "	Sept. 9	6	19.5	7.9	85.5	0.8 0.7*	23	2.6	11		
" "	" "	1941 Jan. 21		3.0	13.7	101.3	2.1 0.8*	0	3.5	30		
Moxahala Creek Below Roseville, Ohio	MuMx 82	1940 Apr. 16	402	10.0	10.9	96.0	1.1 3.1*	9	4.3	78		
" "	" "	" 18	726	14.5	9.6	93.7	1.9 1.5*	9	4.4	120		
" "	" "	" 24	209	10.5	10.2	91.3	2.4 0.9*	1	3.4	91		150
" "	" "	May 27	83	16.0	8.2	82.5	0.7	4	3.0	25		
" "	" "	June 5	62	20.0	7.7	84.0			3.0	18		
" "	" "	" 14	72	22.0	7.6	86.1	0.8	**	3.1	11		
" "	" "	" 24	64	21.5	7.6	84.9	1.1 2.2*		2.9	24		
" "	" "	July 2	33	18.5	8.3	87.5	0.8 1.0*	2	2.9	14		
" "	" "	" 19	**	22.5	6.5	74.8	0.6 1.3*		2.8	7		
" "	" "	" 29	3	26.5	6.0	74.3	1.3 1.9*	**	2.8	7		
" "	" "	Aug. 6	4	24.0	6.8	79.4	1.6 2.5*		3.0	17		
" "	" "	" 14	6	24.0	6.4	75.0	1.0 2.5*	**	2.8	4		
" "	" "	" 22	2	18.0	6.4	67.1	1.7 2.3		2.7			
" "	" "	" 30	672	21.0	7.4	81.8	2.1 3.0*	325	3.3	650		
" "	" "	Sept. 9	8	19.5	7.3	78.9	0.8 0.4*		2.5			
" "	" "	1941 Jan. 21		3.0	13.5	100.1	1.6 0.4*	2	3.3	30		
Moxahala Creek 3 mile above mouth 1 mi. bel. Zanesville, O.	MuMx 73.5	1940 May 7	278	18.0	8.4	88.1	1.1 1.3*	1	3.0	145		300
" "	" "	" 9	215	14.0	9.0	86.6	1.0 1.5*	**	4.6	32		176
" "	" "	" 14	195	18.5	8.8	93.8	1.1 1.2*	**	4.3	14		288
Muskingum River 4 miles bel. Zanesville, Ohio	Mu 71	May 7	7,150	15.5	9.8	97.9	2.2	4	7.4		93	
" "	" "	" 8	6,000	15.5	9.5	94.5	2.1	24	7.4			
" "	" "	" 9	5,200	14.0	9.2	88.8	2.5	240	7.5	28		
Muskingum River 7 miles below Zanesville, Ohio	Mu 67	May 7	7,150	16.0	9.8	98.4	1.9	9	7.5	38	87	164
" "	" "	" 8	6,000	15.5	9.6	95.3	0.8	46	7.5	30		172
" "	" "	" 9	5,200	14.5	9.4	91.7	2.2	43	7.5			192
Muskingum River city limits above McConnelsville, Ohio	Mu 49	Apr. 16	25,200	11.5	12.3	112.0	2.8	24	7.1			
" "	" "	" 18	24,800	11.0	11.0	99.5	1.9	46	7.3			
" "	" "	" 24	31,500	13.0	11.4	107.5	1.3	43	7.3			
Muskingum River ½ mile above McConnelsville, Ohio	Mu 48.5	May 27	16,200	16.5	9.5	96.4	2.4	43	7.2	125	70	
" "	" "	June 5	10,600	19.5	8.7	94.1	1.2	14	7.4	45	68	
" "	" "	" 14	16,200	24.0	7.5	88.4	2.0	110	7.2	300	67	
" "	" "	" 24	6,350	23.0	8.2	94.8	1.4	23	7.6	80	90	
" "	" "	July 2	16,800	20.0	8.7	95.0	2.0	1,100	7.0	250	67	
" "	" "	" 19	3,510	24.5	8.0	94.2	2.1		7.8	14	107	
" "	" "	" 29	5,950	28.5	7.1	90.4	2.7	4	7.5	80	79	
" "	" "	Aug. 6	1,490	27.5	8.0	100.8	2.7		7.8	14	105	

TABLE Mu-7 MUSKINGUM RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c. f. s.	Temp. °C	Dissolved Oxygen p. p. m.	Dissolved Oxygen % Sat.	5 Day B. O. D. p. p. m.	Coliforms M. P. N. Per ml.	pH	Turbidity p. p. m.	Alkalinity p. p. m.	Hardness p. p. m.
Muskingum River ½ mile above McConnelsville, Ohio	Mu 48.5	Aug. 14	1,260	27.5	6.8	84.8	2.1	**	7.8	12	132	
" "	" "	" 22	1,800	25.0	8.2	98.1	2.6	**	7.3	14	120	
" "	" "	" 30	8,040	22.0	7.8	88.1	3.6	23	7.0	89	85	
" "	" "	Sept. 9	2,040	23.5	7.8	90.2	2.0	4	7.2	16	92	
" "	" "	1941 Jan. 21	8,350	1.0	14.1	98.9	1.0	83	7.5	27	78	
Muskingum River Lock Wall at Dam Bel.McConnelsville,O.	Mu 48	1940 Apr. 16	25,200	10.5	12.3	109.9	2.2	46	7.0	155	50	112
" "	" "	" 18	24,800	9.5	11.3	98.4	2.2	110	7.2	100	276	
" "	" "	" 24	31,500	12.0	11.5	106.5	1.4	43	7.2		44	104
Muskingum River 1.1 miles below McConnelsville, Ohio	Mu 47	May 27	16,200	16.5	9.7	98.5	2.5	75	7.2	140	66	
" "	" "	June 5	10,600	19.5	8.9	96.3	1.4	15	7.5	60	67	
" "	" "	" 14	16,200	24.0	7.8	90.9	2.9	110	7.4	540	67	
" "	" "	" 24	6,350	21.5	8.4	94.2	1.4	43	7.7	90	93	
" "	" "	July 2	16,800	19.5	8.9	96.1	5.6	93	7.1	420	66	
" "	" "	" 19	3,510	25.0	8.2	97.3	2.4	23	8.0	15	105	
" "	" "	July 29	5,950	28.5	7.4	94.3	2.5	43	7.5	81	82	
" "	" "	Aug. 6	1,490	27.0	7.5	93.2	2.7	24	8.0	16	103	
" "	" "	" 14	1,260	28.0	6.4	80.4	2.0	39	7.8	11	130	
" "	" "	" 22	1,800	22.0	8.3	93.6	2.4	46	7.5	32	118	
" "	" "	" 30	8,040	22.5	8.0	91.4	3.4	230	7.1	103	85	
" "	" "	Sept. 9	2,040	23.5	9.8	114.5	2.3	15	7.3	18	93	
" "	" "	1941 Jan. 21	8,350	1.0	14.2	99.8	1.2	93	7.6	30	82	
Muskingum River Mile 0.2-at mouth Marietta, Ohio	Mu 0.2	1940 May 1	22,100	12.5	10.8	100.6	1.5	4	6.8	85	56	
" "	" "	" 7	10,500	13.5	10.6	100.8	1.5	46	7.4	50	74	
" "	" "	" 9	7,360	14.5	10.2	99.3	1.3	2	7.4	18	84	
" "	" "	" 13	4,880	16.0	9.7	97.3	1.8	4	7.5	7	98	
" "	" "	" 15	4,610	18.0	8.5	89.1	1.7	5	7.4	8	104	
" "	" "	" 17	4,920	15.5	9.5	94.8	1.5	4	7.4	12	105	
" "	" "	" 21	4,580	18.5	9.2	97.9	2.1	4	7.5	12	106	
" "	" "	" 23	4,170	19.0	9.1	97.4	1.6	2	7.6	11	104	
" "	" "	May 27	18,200	16.0	10.0	100.3	2.6	11	7.3	230	75	
" "	" "	" 29	15,000	16.5	9.7	98.5	1.9	24	7.1	110	64	
" "	" "	" 31	11,300	15.5	9.7	96.9	2.5	43	6.9	180	69	
" "	" "	June 4	19,700	17.5	9.7	100.8	1.8	15	7.2	112	63	
" "	" "	" 6	11,500	20.0	9.1	98.8	1.4	9	7.7	50	69	
" "	" "	" 10	7,600	23.5	8.3	96.6	2.1	110	7.5	230	86	
" "	" "	" 12	16,100	24.0	8.3	97.2	2.6	1,100	7.4	730	83	
" "	" "	" 14	18,200	24.0	8.4	98.4	2.2	36	7.6	420	66	
" "	" "	" 18	10,800	24.0	8.1	95.2	1.6	240	7.2	370	75	
" "	" "	" 20	11,700	23.0	8.3	96.1	1.3	36	7.5	175	87	
" "	" "	" 24	7,100	22.5	8.5	96.7	1.2		7.7	89	80	
" "	" "	" 26	9,050	21.0	8.6	96.0	1.2	9	7.5	100	94	
" "	" "	" 28	8,070	22	8.4	96.4	1.1	9	7.6	100	93	
" "	" "	July 2	16,100	20.0	9.0	98.5	1.7	110	7.2	340	77	
" "	" "	" 10	5,370	23.5	8.5	98.8	1.1	4	7.5	56	84	
" "	" "	" 12	4,170	24.0	8.3	97.6	1.7	4	7.4	17	92	

TABLE Mu-7 MUSKINGUM RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c. f. s.	Temp. °C	Dissolved Oxygen p. p. m.	Dissolved Oxygen % Sat.	5 Day B. O. D. p. p. m.	Coliforms M. P. N. Per ml	pH	Turbidity p. p. m.	Alkalinity p. p. m.	Hardness p. p. m.
Muskingum River Mile 0.2-at mouth Marietta, Ohio	Mu 0.2	July 16	4,490	24.5	8.3	98.3	2.1	2	7.4	12	110	
" "	" "	" 18	3,730	24.5	8.2	97.4	1.7	2	7.7	15	107	
" "	" "	" 22	2,960	27.0	7.7	95.9	2.1	2	7.8	12	108	
" "	" "	" 24	2,900	28.0	7.8	98.5	2.5	93	7.9	12	113	
" "	" "	" 26	5,030	28.5	7.7	98.2	1.8	36	7.9	23	116	
" "	" "	" 30	6,450	29.5	7.7	99.9	2.3		7.7	16	93	
" "	" "	Aug. 1	3,880	28.0	7.9	99.7	2.1	4	7.7	17	81	
" "	" "	" 5	2,080	27.5	8.0	99.6	2.3	2	8.3	12	65	
" "	" "	" 7	1,620	27.5	7.0	88.0	2.0	5	7.8	13	78	
" "	" "	" 9	1,950	27.5	7.4	92.6	2.1	46	7.3	12	85	
" "	" "	" 13	1,470	28.0	7.4	93.4	2.1	9	7.5	12	105	
" "	" "	" 15	1,370	27.5	7.4	92.4	2.6	24	7.5	13	109	
" "	" "	" 19	1,220	26.5	7.1	87.0	1.6	4	7.6	24	124	
" "	" "	" 21	2,320	25.0	7.3	86.7	1.5	4	7.5	18	131	
" "	" "	" 23	1,950	25.0	7.5	89.9	2.1	2	7.4	18	134	
" "	" "	" 27	1,200	24.5	7.6	90.3	1.6	4	7.4	14	127	
" "	" "	Aug. 29	3,490	23.0	7.5	86.9	2.3	43	7.3	500	80	
" "	" "	Sept. 4	6,890	22.0	8.6	97.4	1.3	23	6.9	75	63	
" "	" "	" 6	3, 40	22.5	8.4	96.0	1.3	9	6.8	55	70	
" "	" "	" 10	2,210	22.5	7.9	90.6	1.5	24	6.7	28	78	
" "	" "	" 12	2,270	20.5	8.1	89.1	1.0	4	6.6	31	83	
" "	" "	" 16	1,790	20.0	8.4	91.4	1.7	3	6.3	42	104	
Muskingum River 0.2 - Dam No. 1	Mu 0.2	1941 Jan. 15	6,020	1.5	14.0	99.6	1.4	110	7.0	20	86	
" "	" "	" 17	6,670	3.5	13.3*	100.2	0.9	240	6.9	26	91	
" "	" "	" 21	9,060	1.5	14.0	100.1	1.7	210	7.7	25	92	
" "	" "	" 23	7.740	1.5	14.1	100.5	1.2	46	7.5	35	85	
" "	" "	" 27	10,800	1.5	14.3	102.0	1.8	75	7.5	65	80	
" "	" "	" 29	10,500	0.5	14.5	100.6	1.4	21	7.4	55	73	
" "	" "	" 31	9,550	1.0	14.4	100.9	1.6	46	7.5	25	79	
" "	" "	Feb. 4	11,700	0.5	13.9	96.7	1.3	150	7.5	40	77	
" "	" "	" 6	9,320	2.0	13.8	99.8	0.9	93	7.5	35	75	
" "	" "	Mar. 6	12,500	1.5	14.0	99.8	1.2	23	7.6	35	98	
" "	" "	" 10	7,110	1.5	14.0	99.8	2.0	240	7.6	110	70	
" "	" "	" 12	7,600	2.0	13.7	99.3	1.6	23	7.5	15	74	
" "	" "	" 14	9,790	2.5	13.8	100.6	1.2	43	7.6	45	75	
" "	" "	" 18	8,810	0.0	13.9	95.1	1.1	24	7.7	35	74	
" "	" "	" 20	6,900	1.0	14.0	98.4	1.0	9	7.7	35	74	
" "	" "	" 26	5,710	4.5	12.6	97.3	1.2	24	7.7	25	121	
" "	" "	" 28	5,550	5.5	12.4	98.2	1.2	4	7.7	14	83	

* Seeded and neutralized.

** Less than one.

HOCKING RIVER BASIN

Final Report to the Ohio River Committee

Ohio River Pollution Survey

U. S. Public Health Service
Cincinnati, Ohio
1942

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HOCKING RIVER BASIN

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HOCKING RIVER BASIN*

Syllabus and Conclusions

Syllabus

The Hocking River Basin (area 1,185 square miles) lies in the hilly country of southeastern Ohio. Of the total population of 113,000 about 40 percent is in urban communities. Coal mining and agriculture are the principal industries. None of the 16 public water supplies are taken from polluted streams. Some 48,000 people are served by sewers and about half of the sewage is treated. A number of the tributary streams are strongly acid from mine drainage. Although mine sealing has reduced the acidity, a high degree of restoration of these streams may be delayed until mine sealing activities are modified to bring worked out sections of active mines under control.

The remaining pollution problems of the area can be effectively dealt with by known methods of waste treatment. Flow regulation by proposed flood-control reservoirs, while desirable, would not produce appreciable tangible benefits.

Conclusions

(1) All public water supplies are from underground or upland impounded sources and are not important factors in pollution problems.

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* For maps of this basin see Muskingum River Basin.

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(2) Sewage from 48,400 people and industrial wastes with a population equivalent of 8,600 are discharged to sewers. About half of the sewage is treated. The industrial wastes can be treated in municipal treatment plants.

(3) Laboratory results indicate stream conditions to be generally good in this basin. Pollution problems occur below Lancaster, Logan and Athens.

(4) Primary treatment of all wastes now discharged untreated to the main stream should be sufficient to maintain satisfactory stream conditions. Pending further control of acid mine drainage, primary treatment is probably the limit now justified on certain acid tributaries.

(5) Secondary treatment will be required to prevent local nuisances below significant sources of pollution on the remaining minor tributaries.

(6) The mine sealing program should be revived and continued as far as practicable. Drainage from active mines constitutes an important source of acid.

(7) The estimated comparative costs of pollution abatement programs, as summarized from Table H-1, follow:

Treatment	Capital Cost	Annual Charges
Existing	$ 840,000	$ 70,000
Suggested Additional	620,000	55,000

Estimated additional costs over existing charges of programs involving uniform treatment throughout the basin are:

Primary, all places	590,000	50,000
Secondary, all places	760,000	75,000

Table H-1 Hocking River Basin - Estimated Cost of Existing and Suggested Minimum Corrective Measures for Sewage and Industrial Wastes, with Comparative Costs for Primary and Secondary Treatment.

	Number of Plants		Population Connected to Sewers	Capital Investment (Dollars)	Annual Charges (Dollars)		
	Prim.	Sec.			Amort. & Interest	Operation & Main.	Total
Existing Sewage Treatment	2	2	24,000	840,000	50,000	20,000	70,000
Suggested Minimum Correction							
Sewage Treatment Plants	5	2	23,400	380,000	27,000	17,000	44,000
Required Interceptors			-	240,000	11,000	-	11,000
Independent Industrial Waste Correction	-		-	-	-	-	-
Total				620,000	38,000	17,000	55,000
Comparative Cost							
Primary Treatment All Waste				590,000	35,000	15,000	50,000
Secondary Treatment All Waste				760,000	50,000	25,000	75,000
As Suggested				620,000	38,000	17,000	55,000

Description

The Hocking River drains 1,185 square miles of hilly country in southeastern Ohio and joins the Ohio River 15 miles below Parkersburg, W.Va. The populations of the urban communities and of the basin are shown below.

Urban Communities	Populations			
	1910	1920	1930	1940
Lancaster	13,093	14,706	18,716	21,940
Athens	5,463	6,418	7,252	7,696
Logan	4,850	5,493	6,080	6,177
Nelsonville	6,082	6,440	5,322	5,368
New Lexington	2,559	3,157	3,901	4,049
Glouster	2,527	3,140	2,903	2,903
Total Basin				
Rural	74,729	74,512	63,188	65,422
Urban	34,574	39,354	44,174	48,133
Total	109,303	113,866	107,362	113,555

The population has not increased appreciably during the past 30 years although the urban communities have grown.

Agriculture and coal mining are the principal occupations. The coal fields in this area were developed early and production has been declining for some time.

Water Uses - The Hocking is not considered a navigable stream. There are no hydroelectric developments. Three small dams at Coolville, Guysville and Athens furnish power for small mills. The upper part of the basin is one of Ohio's noteworthy recreational areas but it depends more on its scenic caves and forests than on its streams for its popularity. A few tributaries not affected by mine drainage and parts of the main river are considered fairly good fishing streams.

Two flood-control reservoirs have been studied by the U. S. Engineer Department in connection with the authorized program for Ohio River flood control. These are near the mouth of the East Branch of Sunday Creek and of Clear Creek. Both would be relatively small since the drainage areas above them are only 32 and 84 square miles respectively.

Presentation of Field Data

Figure Mu-1 shows the location and magnitude of each of the more important sources of pollution in the basin. Figure H-2 shows similar data and, in addition, laboratory data on coliform organisms, dissolved oxygen and B.O.D.

Public Water Supplies - Fifty-one thousand people are served by the 16 public water supplies. All but two of these are from underground sources and neither of the two surface supplies is subject to pollution. Table H-2 shows data on these surface supplies.

Table H-2 Hocking River Basin - Surface Water Supplies

Municipality	Source	Mile (1)	Treatment (2)	Population Served	Consumption M.G.D.
Corning	Impounded-Wells	62	FD	600	0.02
New Lexington	Impounded	110	FD	3,200	0.11
Total (3)				3,800	0.13

(1) Miles above mouth of Hocking River.
(2) FD - Coagulated, settled, filtered, chlorinated.
(3) Neither of these supplies is below community sewer outfalls.

Sewerage - Table H-3 shows the sewered population at each of the more important sources of pollution. About 48,400 people are connected to sewers and about half of the sewage is treated before being discharged to the streams.

Industrial Wastes - Two meat packing houses, a brewery, a cheese factory and a milk receiving station are the only sources of industrial wastes in the basin. The brewery wastes are discharged to a municipal treatment plant and wastes from the milk receiving station are treated on a trickling filter. The other wastes are discharged untreated.

Acid Mine Drainage damages many of the tributaries of the Hocking but does not affect the main stream. Most of the abandoned mines have been sealed to prevent further formation of acid. Figures are not available for the total acid load and the reduction through sealing but the figures for the Muskingum and Hocking Basins together are shown in the Muskingum report.

Table H-3 Hocking River Basin - Sources of Significant Pollution Including Industrial Waste Expressed as Sewered Population Equivalent (B.O.D.)

Municipality	Receiving Stream	Miles Above Mouth of Hocking R.	Population Connected to Sewers	Treatment	Sewered Population Equivalent (B.O.D.)	
					Untreated	Discharged
Athens	Hocking River	35	7,000	None	11,200	11,200
Athens State Hospital	" "	35	2,000	"	2,000	2,000
Nelsonville	" "	53	4,300	"	4,300	4,300
Logan	" "	67	5,600	"	7,200	7,200
Lancaster (1)	" "	89	20,000	Secondary	21,400	3,200
Glouster	Sunday Creek	56	2,000	None	2,000	2,000
Boys Industrial School	Arney Run	95	1,100	Primary	1,100	700
Bremen	Rush Creek	96	1,300	None	2,700	2,700
Somerset	Mud Run (2)	112	1,100	"	1,100	1,100
New Lexington	Little Rush Cr.	110	2,700	Secondary	2,700	400
9 smaller sources			1,300	(3)	1,300	1,200
Total			48,400		57,000	36,000

(1) Sewage treatment plant under construction at time of laboratory survey.
(2) Also drains to Jonathan Creek, tributary of Muskingum River.
(3) One primary plant. No treatment at 8 other places.

FIG. H-2

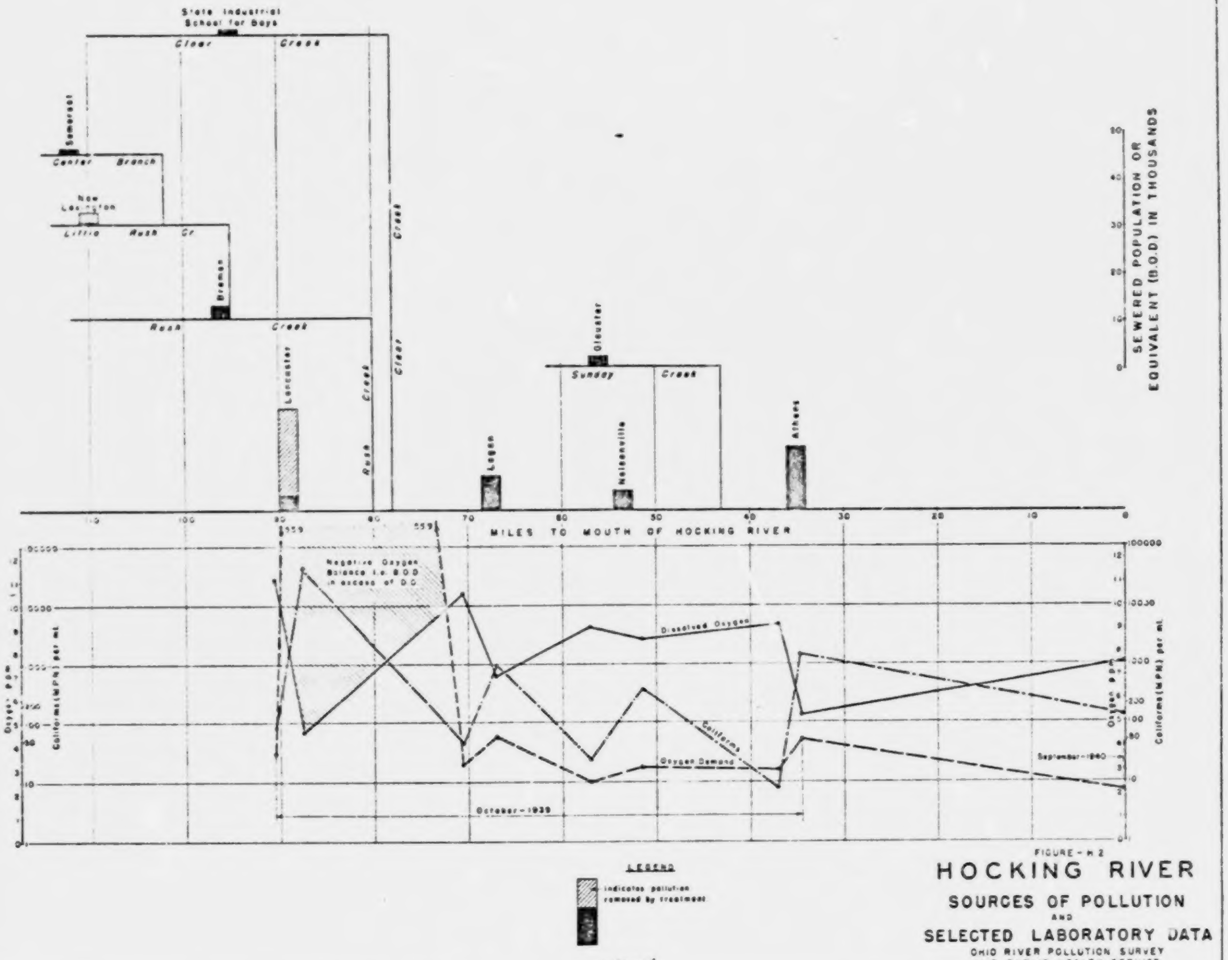

FIGURE - H 2

HOCKING RIVER
SOURCES OF POLLUTION
AND
SELECTED LABORATORY DATA

OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941

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Presentation of Laboratory Data

Analyses of water from the Hocking River and its tributaries were made at a trailer laboratory in October 1939 and April, 1940 and at the Kiski laboratory during the period April-September, 1940. Summaries of laboratory findings are presented in Table H-7 and selected data are shown in Table H-5. Coliform, dissolved oxygen and oxygen demand results are shown in Figures Mu-3, Mu-4 and Mu-5 on the basis of the most unfavorable monthly average where observations were for long periods and averages of one to three samples where sampling was for periods of less than a month.

The laboratory observations indicate that the major pollution problems in this basin occur below Lancaster, Logan and Athens, with acid wastes complicating the problem below New Lexington and on Sunday and Monday Creeks. The dissolved oxygen in the streams at the times of sampling generally averaged over 6.5 p.p.m. at most of the points. The lowest observed dissolved oxygen was 1.2 p.p.m. below Corning and averages of 3.5 to 4.5 p.p.m. were observed at Murray City and Lancaster. The coliform observations generally revealed more unfavorable pollutional conditions than did the dissolved oxygen results. The results on Sunday and Monday Creeks are influenced by the acid conditions of these waters.

The B.O.D. results were generally below 3.0 p.p.m. Even below sources of pollution it did not exceed 5.0 p.p.m. except in a few instances. The highest average was 56 p.p.m. below Lancaster. The oxygen demand samples from those areas affected by acid drainage were neutralized and seeded to obtain an indication of the behavior of the oxygen demand under more normal conditions. These results are shown in Table H-7 along with the other data. The oxygen demand of these acid waters was usually quite low and both the neutralized and unneutralized samples gave results of the same order of magnitude, as a rule. Where this was not so, the unneutralized samples usually gave the higher results, as might be expected where ferrous iron may be present. Acid conditions were found at New Lexington on Little Rush Creek, Shawnee, New Straitsville and Murray City on Monday Creek, and Corning, Glouster and Jacksonville on Sunday Creek. pH values as low as 2.5 were found and phenolphthalein acidities as high as 1400 p.p.m. The pH values were within a range of 7.0 to 8.0 except where acid wastes were present. Alkalinity and hardness values in the normal streams were in the range of 100-200 p.p.m.

Coliform counts observed above most communities were reasonably low, except above Lancaster, Haydenville, Corning and Athens. There is some evidence of self-purification in the reduction of coliforms from Lancaster to Logan, from Haydenville to Nelsonville and from Nelsonville to Athens along the main stream, although in the last mentioned stretch it is not as well marked as in the other two.

Biological Summary - The flora and fauna of the Hocking were found to be comparatively low. The plankton volume was not more than 5,000 p.p.m. and the fish population consisted of only a few species and numbers. Sunday and Monday Creeks were found to be too acid to support aquatic life.

Table H-5 Hocking River Basin - Selected Laboratory Data

River Location	Hocking River above Lancaster	Hocking River below Lancaster	Hocking River above Logan	Hocking River below Logan	Hocking River above Nelsonville	Hocking River below Nelsonville
River Miles Above: Mouth of Hocking	90.5	87.5	70.5	67	57	51.5
Period - 1939	Oct.	Oct.	Oct.	Oct.	Oct.	Oct.
Number of Samples	5	3	3	3	3	3
Flow in c.f.s.:						
Sampling Days	8	9	52	52	65	65
Minimum Month	12.2	12.2	-	-	-	-
Water Temperature °C.	9.8	11.2	9.3	8.8	9.5	9.5
Coliforms per ml.	84	41,600	45	960	24	377
Dissolved oxygen ppm.	11.1	3.7	10.5	7.0	9.1	8.6
B.O.D., 5-day, p.p.m.	4.6	55.9	3.2	4.4	2.5	3.1

River Location	Hocking River above Athens	Hocking River below Athens	Hocking R. at Hockingport	Little Rush Cr. above New Lexington	Little Rush Cr. below New Lexington	Little Rush Cr. above Bremen	Little Rush Cr. below Bremen
River Miles Above: Mouth of Hocking	37	34.5	0.1	110.5	108.8	97	95
Period -	Aug.'40	Aug.'40	Aug.'40	Oct.'39	Oct.'39	Oct.'39	Oct.'39
Number of Samples	2	2	4	3	3	3	3
Flow in c.f.s.:							
Sampling Days	320	320	195	25	25	45	45
Minimum Month	36.1	36.1	-	-	-	-	-
Water Temperature °C.	22.8	23.3	25.4	6.7	7.3	10.5	10.3
Coliforms per ml.	68	5,850	127	1	113	24	530
Dissolved oxygen ppm.	7.8	6.7	7.6	11.4	11.2	8.5	6.7
B.O.D., 5-day, p.p.m.	1.7	3.9	2.1	3.3	7.0	2.1	4.7

Hydrometric Data

Three stream gaging stations have been maintained on the Hocking River, two of which are currently in operation. Table H-6 shows monthly mean summer flows during the driest years of record at all three of the stations:

Table H-6 Hocking River Basin - Monthly Mean Summer Flows for Years in Which Low Summer Flows have Occurred.

River Location		Hocking River Lancaster, Ohio	Hocking River Enterprise, Ohio	Hocking River Athens, Ohio
River Miles Above:				
Mouth of Hocking R.		89	72	35
Drain. Area Sq.Mi.		92.8	460	944
Period of Record		1923-32	1931-40	1915-40
Year		1930	1936	1930
June	c.f.s.	19.8	68.1	77.8
July	"	12.5	88.7	52.2
August	"	12.2	98.1	39.6
September	"	15.9	36.3	44.8
Year		1925	1932	1925
June	"	26.6	112	128
July	"	29.8	256	314
August	"	56.3	39.9	191
September	"	12.3	57.2	51.6
Year		1932	1939	1936
June	"	45.9	322	110
July	"	85.8	183	109
August	"	17.3	140	116
September	"	15.1	40.3	58.0

Discussion

The Hocking River is not heavily polluted. The largest sources of untreated organic wastes, Athens, Logan and Nelsonville, are on the main stream where stream flows are generally sufficient to prevent gross nuisances from their discharge. Primary treatment should be sufficient to maintain good stream conditions at these points at all times. At Glouster the receiving stream is acid and, although discharges become very low, the provision of secondary treatment does not seem justified. At Bremen and Somerset, secondary treatment probably will be necessary because of the small size of the receiving streams. The treatment plant at the State Industrial School for Boys is inadequately designed and should be rebuilt. Industrial wastes can be treated at the municipal plants.

Further reduction in acid mine drainage can be effected by a renewal of the mine sealing program. A high degree of restoration of acid streams may be delayed until mine sealing activities are modified to bring worked out sections of active mines under control.

Increased low flows from the proposed flood-control reservoirs would be desirable but would have no appreciable tangible benefits. The estimated cost of the suggested pollution abatement program is summarized in Table H-1.

TABLE H-7 HOCKING RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth		Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml.	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Hocking River 1 mile abv. Lancaster, Ohio	Ho	90.5	Oct. 18	6	9.0	13.3	114.8	3.3	46	8.2	58	206	231
" "	"	"	" 23	6	9.5	11.1	96.9	6.4	46	8.0	93	240	
" "	"	"	" 25	1	12.5	9.2	86.0	6.2	110	7.9	70	252	
" "	"	"	" 30	11	7.5	11.4	95.0	2.2	110	8.1	39	240	165
" "	"	"	" 31	9	10.5	10.4	93.0	0.3	110	8.3	53	243	
Hocking R. 1/8 mile below Lancaster, Ohio	Ho	87.5	Oct. 25	6	13.0	1.7	16.3	130	43,000	7.3	109	200	
" "	"	"	" 30	11	9.0	7.0	60.3	11.8	39,000	7.5	18	266	175
" "	"	"	" 31	9	11.5	5.2	47.6	26.0	43,000	7.8	21	288	
Little Rush Creek ½ mile above New Lexington, Ohio	HoLr	110.5	Oct. 20	2	14.5	7.7	75.2	5.8	**	2.9	10		
" "	"	"	" 30	3	4.5	12.6	96.8	2.7	2	2.8	3		344
" "	"	"	Nov. 3	2	1.0	14.1	99.0	1.2	**	2.9	8		445
Little Rush Creek 1 1/8 miles below New Lexington, Ohio	HoLr	108.8	Oct. 20	2	15.0	10.0	98.7	7.7	240	3.9	28		
" "	"	"	" 30	3	6.0	11.6	93.0	4.9	93	3.6	46		375
" "	"	"	Nov. 3	2	1.0	12.0	84.1	8.4	7	3.9	29		478
Rush Creek Bridge U.S. 22 Somerset, Ohio	HoR	110	May 2	2	8.0	12.5	105.4	0.9	4	7.3		54	
" "	"	"	" 3	1	6.5	12.0	97.2	0.8	4	7.4			
" "	"	"	" 6	1	14.5	11.3	110.0	1.1	8	7.5			
Rush Creek Side road 1 mile below Somerset, Ohio	HoR	109	May 2	2	7.5	14.1	117.4	1.6	24	7.4		57	
" "	"	"	" 3	1	7.5	12.4	103.3	0.8	24	7.5	8		130
" "	"	"	" 6	1	13.0	11.9	112.1	1.8	24	7.5	7		96
Little Rush Creek 1 mile above Bremen, Ohio	HoLR	97	1939 Oct. 25	15	11.0	7.9	71.0	2.5	2	7.6	10	255	
" "	"	"	" 27	98	13.5	7.9	75.7	1.5	23	7.6	77	173	
" "	"	"	" 31	21	7.0	9.7	79.8	2.4	46	7.5	36	157	423
Little Rush Creek ½ mile below Bremen, Ohio	HoLR	95	1939 Oct. 25	15	11.5	5.0	46.0	9.8	930	7.3	22	197	
" "	"	"	" 27	98	13.0	6.9	65.1	2.1	230	7.4	84	180	
" "	"	"	" 31	21	6.5	8.2	66.6	2.1	430	7.1	32	91	407
Hocking River 1½ mi. west of Logan, Ohio	Ho	70.5	Oct. 18	45	9.0	11.4	98.0	2.9	15	7.9	26	208	203
" "	"	"	" 23	44	11.0	10.4	94.0	3.2	9	7.8	10	210	
" "	"	"	" 31	68	8.0	9.7	81.6	3.5	110	7.5	37	136	
Hocking River 1¼ mi. below Logan, Ohio	Ho	67.0	Oct. 18	45	8.0	7.2	60.6	3.9	2,400	7.6	24	213	201
" "	"	"	" 23	44	10.5	5.6	49.7	4.6	240	7.6	10	205	
" "	"	"	" 31	68	8.0	8.4	70.4	4.8	240	7.4	46	125	
Hocking River 1000Ft. above sewer Haydenville, Ohio	Ho	62.0	1940 Apr. 23	2,180	9.5	9.8	85.8	2.6	93	6.7		64	
" "	"	"	" 25	1,060	10.0	9.6	85.1	1.9	240	7.4		96	
" "	"	"	" 26	854	11.0	9.5	86.1	1.4	93	7.5		98	
Hocking River ½ mile abv. Haydenville, Ohio	Ho	62.0	May 29	475	17.0	9.1	93.4	2.1	110	7.0	30	111	
" "	"	"	June 7	316	23.0	8.8	101.0	0.9	43	7.5	17	128	
" "	"	"	" 18	502	23.5	7.6	87.9	1.8	460	7.5	155	103	
" "	"	"	" 26	258	19.0	7.6	80.9	1.3	430	7.3	102	108	

TABLE H-7 HOCKING RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c. f. s.	Temp. °C	Dissolved Oxygen		5 Day B. O. D. p. p. m.	Coliforms M. P. N. Per ml.	pH	Turbidity p. p. m.	Alkalinity p. p. m.	Hardness p. p. m.
					p. p. m.	% Sat.						
Hocking River ¼ mile abv. Haydenville, Ohio	Ho 62.0	July 5	167	20.0	8.1	88.2	1.2	230	7.5	85	141	
" "	" "	" 15	102	21.0	7.9	87.9	2.1	240	7.7	55	142	
" "	" "	" 23	169	26.0	8.6	106.4	3.6	91	8.0	15	180	
" "	" "	" 31	81	27.0	7.8	97.0	3.4	460	7.7	19	162	
" "	" "	Aug. 8	114	22.5	5.9	67.5	3.8	240	7.6	400	102	
" "	" "	" 26		21.0	6.0	67.2	2.2	430	7.4	110	163	
" "	" "	Sept. 3		20.0	7.8	84.5	1.1	230	7.1	101	114	
" "	" "	" 11		20.5	8.2	90.9	1.0	24	7.3	13	106	
" "	" "	1941 Jan. 24		2.0	12.9	92.9	2.1	110	7.4	110	84	
Hocking River below sewers Haydenville, O.	Ho 61.8	Apr. 23	2,180	10.5	9.8	87.4	1.8	240	6.7		67	
" "	" "	" 25	1,060	10.0	9.7	85.9	1.6	230	7.4		91	
" "	" "	" 26	854	11.5	9.6	87.3	1.7	36	7.6		107	
Hocking River 1 mile below Haydenville, O.	Ho 61.0	May 29	475	17.0	9.2	94.3	0.9	110	7.2	25	111	
" "	" "	June 7	316	23.5	7.6	88.0	0.7	43	7.7	18	108	
" "	" "	" 16	502	23.0	7.3	83.7	[illegible]	1,100	7.6	260	95	
" "	" "	June 26	258	19.0	7.3	78.5	1.3	460	7.4	122	105	
" "	" "	July 5	167	19.0	8.1	86.7	0.9	140	7.5	101	140	
" "	" "	" 15	102	21.0	7.6	84.4	1.9	430	7.7	58	142	
" "	" "	" 23	169	27.5	8.3	104.4	2.7	36	7.9	15	177	
" "	" "	" 31	81	27.0	7.3	91.0	2.2	43	7.9	23	156	
" "	" "	Aug. 8	114	22.0	5.9	67.0	4.1	240	7.7	440	106	
" "	" "	" 26		21.0	7.4	81.8	2.0	460	7.4	95	139	
" "	" "	Sept. 3		20.0	7.6	82.9	1.2	460	7.2	96	107	
" "	" "	" 11		19.0	7.4	79.6	1.9	930	7.3	12	107	
" "	" "	1941 Jan. 24		1.5	12.9	92.1	2.2	150	7.5	100	81	
Hocking River 1½ miles above Nelsonville, Ohio	Ho 57.0	1939 Oct. 20	45	11.0	9.2	82.8	1.9	24	7.9	25	200	
" "	" "	" 25	47	11.5	9.4	86.0	2.3	2	7.5	7	203	
" "	" "	" 30	103	6.0	8.8	70.7	3.2	46	7.4	68	69	165
Hocking R. 1 mile bel. Nelsonville, Ohio	Ho 51.5	1939 Oct. 20	45	11.0	8.7	78.8	2.2	460	7.8	5	200	
" "	" "	" 25	47	12.0	8.4	77.9	3.2	430	7.7	7	224	
" "	" "	" 30	103	5.5	8.6	68.2	3.8	240	7.3	71	65	169
Shawnee Creek 3 miles above Shawnee, Ohio	HoMnSh-72.5	May 28	2	18.0	9.1	95.6	0.3		3.4	2		
" "	" "	June 6	2	17.0	8.7	89.6	0.3	**	3.5			
" "	" "	" 17	2	17.5	7.7	79.9	2.3 2.3*	11	3.7	67		
" "	" "	" 25	2	17.0	9.1	93.0	0.3 0.7*	4	3.5	1		
" "	" "	July 3	1	17.0	9.4	96.8	0.4 0.4*	**	3.4			
" "	" "	" 12	1	17.0	8.8	90.1	0.4 1.4*	**	3.2	9		
" "	" "	" 22	**	23.0	8.0	91.8	0.2 0.4*	**	3.5	6		
" "	" "	" 30	**	22.0	7.3	82.5	0.7 0.5*	**	3.5			
" "	" "	Aug. 7	1	20.5	8.2	90.8	0.8 1.2*	**	3.5			
" "	" "	" 15	**	22.0	7.4	83.4	0.6	5	3.5			
" "	" "	" 23		17.5	7.8	80.4	0.1 0.8*	2	3.3	2		
" "	" "	Sept.10		18.0	7.1	74.0	0.7 0.8*	11	3.3	6		
" "	" "	1941 Jan. 23		5.0	11.4	89.2	0.4 0.9*	**	4.0	6		
Shawnee Creek ¼ mile abv. Shawnee, Ohio	HoMnSh-70	Apr. 25	2	9.5	10.2	89.3	1.0 2.7*	240	4.4			
" "	" "	" 26	1	9.5	10.2	88.8	1.6	4,600	4.5			
" "	" "	" 29	1	8.0	10.0	84.5	1.8 1.4*	35	4.1			

TABLE H-7 HOCKING RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Shawnee Creek ¼ mile bel. Shawnee, Ohio	HoMnSh-68	Apr. 25	2	10.5	10.1	89.8	0.7*	2	4.6	18		1,460
" "	" "	" 26	1	11.5	10.3	93.6	0.4	4	4.6	19		1,470
" "	" "	" 29	1	8.5	10.4	88.8	1.4	**	4.5	[illegible]		1,700
Shawnee Creek 9 mi. below Shawnee, Ohio	HoMnSh-68	May 28	2	19.0	8.3	85.9	1.5	24	4.1	12		
" "	" "	June 6	2	19.5	8.0	86.4	0.6	15	4.3	7		
" "	" "	" 17	2	19.5	8.5	92.0	2.2 3.4*	21	4.3	68		
" "	" "	" 25	2	20.0	8.8	95.7	1.5 2.0*		4.4	8		
" "	" "	July 3	1	16.5	9.7	98.7	1.3 1.6*	1,100	6.4	200		
" "	" "	" 12	1	17.0	9.2	94.1	0.6 0.3*	430	5.3	18		
" "	" "	" 22	**	22.5	8.5	96.9	0.3 0.6*	930	6.2	11		
" "	" "	" 30	**	21.0	7.9	87.7	1.0*	230	5.9	9		
" "	" "	Aug. 7	1	19.5	8.5	91.6	1.0 1.5*	1,100	6.1	7		
" "	" "	" 15	**	21.0	8.0	88.8	1.1*	230	6.1	7		
" "	" "	" 23		16.5	8.8	88.8	0.6 1.0*	93	5.6	7		
" "	" "	Sept. 10		18.0	7.7	80.8	[illegible]	43	4.4	7		
" "	" "	1941 Jan. 23		5.0	12.3	96.1	1.1 1.1*	8	4.7	40		
Sugar Cr. ¼ mile above New Straitsville, Ohio	HoMnSu-67.5	1940 Apr. 23	4	9.5	10.2	89.4	1.8 1.7*	**	3.4			
" "	" "	" 25	2	9.5	9.9	86.4	2.9 1.3*	**	3.5			
" "	" "	" 26	2	10.5	11.3	100.7	1.5 0.6*	**	3.3			
Sugar Cr. 3 mile above New Straitsville, Ohio	HoMnSu-67.5	May 28	2	19.0	11.0	117.3	4.5	2	3.3	1		
" "	" "	June 6	1	25.0	8.3	98.5	0.5	4	3.6	4		
" "	" "	" 17	1	20.0	9.5	103.3	2.7 1.3*	110	3.7	5		
" "	" "	" 25	1	22.5	9.5	108.6	0.9 2.2*		3.6	6		
" "	" "	July 3	**	19.0	8.9	95.0	1.3*	12	3.7	10		
" "	" "	" 12	1	19.5	8.7	94.1	0.7 1.4*	46	3.4	9		
" "	" "	" 22	**	26.0	7.7	93.2	0.3 0.2*	[illegible]	3.7	8		
" "	" "	" 30	**	25.0	7.6	90.9	0.7 0.0*	46	3.7	11		
" "	" "	Aug. 7	**	20.5	8.9	98.0	2.4 1.0*	4	3.7	6		
" "	" "	" 15	**	22.0	7.9	89.8	0.6 0.7*	8	3.7	2		
" "	" "	Aug. 23		18.0	9.1	95.7	1.8 1.4*	46	3.5	19		
" "	" "	Sept. 10		17.5	8.0	83.0	0.7 0.7*	46	3.3	6		
" "	" "	1941 Jan. 23		6.0	11.5	92.0	1.0 0.3*	150	3.7	5		
Sugar Creek City limits below New Straitsville, Ohio	HoMnSu-65.5	Apr. 23	4	10.0	10.2	89.7	1.9 3.5*	4	3.8	22		1,340
" "	" "	" 25	2	10.0	10.1	88.9	1.3 1.2*	**	3.4	8		650
" "	" "	" 26	2	10.0	11.2	96.7	2.5 0.7*	**	3.5	5		700
Sugar Cr. 1 mile bel. New Straitsville, Ohio	HoMnSu-64.5	May 28	2	19.5	8.1	87.8	7.0	**	2.9	7		
" "	" "	June 6	1	21.5	8.7	98.1	1.2	**	3.2	24		
" "	" "	" 17	1	20.0	9.4	103.0	4.3 3.9*	11	3.4	62		
" "	" "	" 25	1	23.0	9.9	113.7	1.0 1.0*		3.2	6		
" "	" "	July 3	**	20.0	8.9	97.4	2.1 2.4*	**	3.2	7		
" "	" "	" 12	1	19.5	9.1	93.4	0.4	11	2.9	6		
" "	" "	" 22	**	27.5	8.9	111.3	1.3 0.8*		3.2	4		
" "	" "	" 30	**	26.0	8.4	101.5	0.7 0.1*	1	3.5	3		
" "	" "	Aug. 7	**	22.5	8.0	91.2	1.1 0.5*	2	3.5	2		
" "	" "	" 15	**	24.0	8.1	95.0	0.3 0.6*	2	3.5	3		

TABLE H-7 HOCKING RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
					p.p.m.	% Sat						
Sugar Creek 1 mile bel. New Straitsville, Ohio	HoMnSu-64.5	Aug. 23		18.0	9.8	102.6	1.6 0.9*	2	3.4			
" "	" "	Sept. 10		19.0	8.3	88.8	1.1 0.7*	11	3.0	4		
" "	" "	1941 Jan. 23		4.0	12.3	93.5	1.0 1.1*	**	3.4	6		
Red Fork Cr. 1 mile abv. Murray City, Ohio	HoMnRf-57.5	Apr. 23	37	6.5	11.2	91.0	3.2 1.0*	**	3.5			
" "	" "	" 25	21	8.5	9.2	78.8	6.0 1.5*	**	3.2			570
" "	" "	" 26	17	7.5	11.3	94.2	2.4 0.5*	**	3.5	35		
Red Fork Creek City limits below Murray City, Ohio	HoMnRf-55.0	Apr. 23	37	8.0	10.9	91.7	4.9 1.6*	4	3.5			556
" "	" "	" 25	21	10.0	8.8	77.7	5.5 2.3*	**	3.2	50		
" "	" "	" 26	17	9.0	10.6	91.6	4.2 0.4*	**	3.5			480
Snow Creek 2 mile abv. Murray City, Ohio	HoMnSw-56.5	May 28	10	17.5	3.5	36.4	1.2		3.0	10		
" "	" "	June 6	12	19.5	10.3	111.6			3.1	13		
" "	" "	" 17	9	17.5	9.8	101.5	4.2 0.1*	**	3.0	85		
" "	" "	" 26	8	19.0	9.6	102.9	3.0 [illegible]	**	2.9	23		
" "	" "	July 3	2	17.0	8.6	88.2	2.2 0.3*		2.8	48		
" "	" "	" 12	6	18.0	8.4	87.7	1.2 0.5*		2.5	20		
" "	" "	" 22	**	20.5	8.2	90.4	1.0 0.4*		2.8	7		
" "	" "	" 30	1	22.0	8.4	94.7	0.7 0.4*		3.1	5		
" "	" "	Aug. 7	2	20.0	9.0	98.4	0.4 0.6*		2.9			
" "	" "	" 15	1	21.5	8.2	92.1	0.8 0.4*		2.9	4		
" "	" "	" 23		18.0	9.4	98.5	0.8 0.8*		2.6			
" "	" "	Sept. 10		17.0	8.5	89.1	1.1 1.1*		2.5	4		
" "	" "	1941 Jan. 23		[illegible]	12.9	99.6	2.6 0.6*	0	4.4	22		
Snow Creek 1 mile bel. Murray City, Ohio	HoMnSw-54	May 28	10	17.0	5.7	58.3	1.0		2.8	24		
" "	" "	June 6	12	21.5	10.2	114.1	0.5		2.9	12		
" "	" "	" 17	9	20.0	8.9	97.4	4.8 0.6*		2.8	12		
" "	" "	" 25	8	22.0	9.0	102.4	5.7 0.7*	2	2.8	5		
" "	" "	July 3	2	20.5	8.4	92.2	2.9 1.3*		2.7	5		
" "	" "	" 12	6	20.0	7.6	83.3	2.6 1.1*	**	2.5	5		
" "	" "	July 22	**	22.5	7.1	81.5	1.9 0.4*		2.7	6		
" "	" "	" 30	1	26.0	7.3	88.7	2.4 0.6*		3.0	3		
" "	" "	Aug. 7	2	23.5	7.5	86.7	1.5 1.2*		2.9	2		
" "	" "	" 15	1	23.5	6.7	78.2	1.3 0.9*		[illegible]	2		
" "	" "	" 23		19.0	7.4	78.6	1.5 0.7*		2.6			
" "	" "	Sept. 10		20.0	8.6	94.0	2.5 1.2*		2.5	4		
" "	" "	1941 Jan. 23		4.0	12.5	95.1	2.0 0.6*	24	5.6	30		
Town Creek City limits above Corning, Ohio	HoSnTn-65	1940 Apr. 16	38	8.5	10.8	92.2	1.7 2.8*	**	6.0			
" "	" "	" 18	69	13.0	10.2	96.6	1.1	4	7.1		11	
" "	" "	" 24	20	8.0	10.8	90.6	1.6	2	6.7			
Town Creek City limits below Corning, Ohio	HoSnTn-63	Apr. 16	38	7.0	10.6	87.1	1.0 1.2*	46	6.1	42		136
" "	" "	" 18	69	13.5	8.9	84.9	1.0	15	6.6	85	8	
" "	" "	" 24	20	9.5	11.2	98.2	0.3	4	5.2	72	9	410

TABLE H-7 HOCKING RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C.	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliform M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
					p.p.m.	% Sat.						
Sunday Creek [illegible] mile above Corning, Ohio	HoSn 65	May 28	6	14.0	10.2	98.0	0.6	2	7.0	2	57	
" "	" "	June 6	8	20.0	8.7	94.8	0.4	110	7.1		59	
" "	" "	" 17	6	21.0	8.0	88.5	1.3	460	7.4	32	65	
" "	" "	2 25	5	19.0	8.5	90.9	1.0	110	7.0	92	65	
Sunday Creek .4 mile abv. Corning, Ohio	" "	July 3	2	18.0	9.2	96.3	0.6	150	7.5	13	74	
" "	" "	" 12	1	19.5	7.6	82.2	2.6	1,100	6.7	350	61	
" "	" "	" 22	**	22.0	5.2	58.7	1.5		7.2	20	20	
" "	" "	" 30	**	24.5	6.7	79.2	0.9	15	7.1	7	75	
" "	" "	Aug. 7	**	20.5	7.3	80.3	1.3	110	6.9	12	49	
" "	" "	" 15	1	23.0	4.4	50.3	2.7	1,100	6.8	24	71	
" "	" "	" 23		18.5	8.3	87.7	2.0	91	6.7	27	65	
" "	" "	Sept. 10		18.5	7.6	80.7	0.8	210	7.1	5	82	
" "	" "	1941 Jan 23		2.5	13.4	97.8	0.6	93	7.0	24	45	
Sunday Creek 1.5 miles bel. Corning, Ohio	HoSn 63	1940 May 28	6	14.0	1.2	11.9	1.0	**	4.4	25		
" "	" "	June 6	8	18.0	8.8	92.3	0.2	46	3.7	23		
" "	" "	" 17	6	19.5	6.4	69.1	7.9 0.4*	93	3.6	60		
" "	" "	June 25	5	17.0	9.1	93.3	7.2 0.1*	9	3.9	17		
" "	" "	July 3	2	16.0	7.4	74.3	7.1 0.0*	9	3.5	16		
" "	" "	" 12	1	19.0	7.5	80.3	7.8 0.8*	24	3.7	18		
" "	" "	" 22	**	22.0	4.3	48.9	6.2 0.[illegible]*		3.0	40		
" "	" "	" 30	**	20.5	4.0	44.1	6.3 1.0*		3.0	41		
" "	" "	Aug. 7	**	18.0	5.1	53.4	6.9 1.3*		3.0	22		
" "	" "	" 15	1	18.0	7.1	74.2	7.7	**	3.1	12		
" "	" "	" 23		16.5	6.7	67.7	7.6 0.9*		2.8	16		
" "	" "	Sept. 10		17.5	4.9	51.0	3.0 1.8*	**	2.7	9		
" "	" "	1941 Jan. 23		3.0	12.9	95.4	1.0	46	6.9	45	42	
Sunday Creek 1 mile above Glouster, Ohio	HoSn 58	1939 Oct. 20	13	12.5	12.1	112.9	7.7	**	2.9	12		
" "	" "	" 26	10	15.5	11.5	114.4	4.1	**	3.2	60		
" "	" "	Nov. 3	9	1.0	9.9	69.8	2.7	**	4.8	20		414
Sunday Cr. ½ mile bel. Jacksonville, Ohio	HoSn 52.5	Oct. 20	13	11.5	8.0	73.4	16.3	4	2.9	17		
" "	" "	" 26	10	14.5	9.1	88.4	9.1	15	3.4	69		
" "	" "	Nov. 3	8	1.5	10.4	74.1	2.2	46	6.4	20		838
Hocking River above city limits Athens, Ohio	Ho 37	Oct. 18	49	6.5	10.2	82.6	4.0	4	7.4	36	172	163
" "	" "	" 23	55	13.0	8.6	80.8	2.9	9	7.3	26	167	
" "	" "	" 31	142	9.0	8.8	76.4	2.1	9	7.0	17	50	
Hocking River City limits Athens, Ohio	Ho 37	1940 Apr. 17	4,200	12.5	9.8	91.0	2.8	240	6.5			
" "	" "	" 18	6,310	11.0	9.7	87.3	2.5	43	6.5			
" "	" "	" 23	6,400	11.5	9.8	89.1	1.6	43	6.2		32	
" "	" "	" 29	1,000	14.5	9.0	87.9	2.2	4	6.9			
" "	" "	May 29	699	17.0	8.6	88.6	0.7	46	6.6	36	52	
" "	" "	June 7	571	23.0	7.5	86.1	0.8	46	7.0	[illegible]	66	
" "	" "	" 18	1,110	23.0	7.9	91.0	0.7	460	6.9	160	43	
" "	" "	" 26	421	19.0	8.0	85.1	0.8	230	6.8	78	65	

TABLE H-7 HOCKING RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth		Date 1940	Average Discharge c. f. s.	Temp. °C.	Dissolved Oxygen		5 Day B. O. D. p. p. m.	Coliform M. P. N. Per ml.	pH	Turbidity p. p. m.	Alkalinity p. p. m.	Hardness p. p. m.
						p. p. m.	% Sat.						
Hocking River City limits Athens, Ohio	Ho	37	July 5	252	20.0	8.0	87.5	0.7	230	6.9	39	81	
" "	"	"	" 15	148	22.0	8.4	94.9	1.3	3	7.3	8	98	
" "	"	"	" 23	103	28.0	7.6	96.0	1.1		7.5	12	109	
" "	"	"	" 31	114	28.0	6.5	82.2	0.6	93	7.2	18	70	
" "	"	"	Aug. 8	320	23.5	6.8	79.4	2.0	15	7.4	17	127	
" "	"	"	" 26	172	22.0	8.7	98.9	1.3	120	7.3	14	110	
" "	"	"	Sept. 3	431	20.5	7.6	83.3	0.4	23	6.7	41	55	
" "	"	"	" 11	157	17.0	7.6	78.1	1.2	460	7.2	24	66	
" "	"	"	1941 Jan. 24	2,460	4.0	13.1	99.5	0.8	15	7.1	40	59	
Hocking River City limits Below Athens, Ohio	Ho	34.5	1939 Oct. 18	49	9.0	3.8	33.2	4.9	1,100	7.3	21	157	167
" "	"	"	" 23	55	11.0	3.9	35.0	5.3	1,500	7.4	8	168	
" "	"	"	" 31	142	10.0	8.1	71.6	5.6	1,500	7.1	58	65	
" "	"	"	1940 Apr. 17	4,200	12.5	10.4	97.6	2.5	93	6.5	245	33	
" "	"	"	" 18	6,310	11.5	9.8	89.6	2.8	240	6.5	375	20	
" "	"	"	" 23	6,400	11.0	10.0	90.1	0.6	93	6.2	105		132
" "	"	"	Apr. 29	1,000	14.0	9.6	92.6	1.4	23	7.1	110	32	230
" "	"	"	May 29	699	17.0	9.0	92.4	1.8	110	6.6	32	53	
" "	"	"	June 7	571	23.5	7.8	90.8	0.7	240	7.5	12	67	
" "	"	"	" 18	1,110	23.0	7.6	88.1	1.6	930	7.2	180	62	
" "	"	"	" 26	421	20.0	7.9	86.5	0.6	430	7.1	26	76	
" "	"	"	July 5	252	19.5	8.1	87.6	0.8	200	7.0	23	67	
" "	"	"	" 15	148	21.5	7.3	82.3	2.4	750	7.4	10	104	
" "	"	"	" 23	103	27.5	5.2	65.4	1.6	930	7.5	8	107	
" "	"	"	" 31	114	27.5	5.4	67.9	1.0	1,500	7.3	12	81	
" "	"	"	Aug 8	320	25.0	7.4	88.4	2.7	2,400	7.5	12	106	
" "	"	"	" 26	172	21.5	6.0	67.4	5.0	9,300	7.4	375	96	
" "	"	"	Sept. 3	431	20.5	8.1	88.7	1.0	360	6.8	40	54	
" "	"	"	" 11	157	17.0	8.0	81.6	1.3	240	7.3	16	167	
" "	"	"	1941 Jan. 24	2,460	3.5	13.2	99.2	5.6	240	7.2	850	66	
Hocking River Hockingport, Ohio	Ho	0.1	May 16	515	16.5	9.7	98.5	1.1	46	7.4	8	95	
" "	"	"	" 20	510	19.5	8.6	93.4	0.9	15	7.4	5	87	
" "	"	"	" 22	408	20.5	8.3	91.4	1.0	9	7.1	23	86	
" "	"	"	" 28	1,010	17.0	9.1	93.0	0.7	24	6.8	12	45	
" "	"	"	June 5	1,020	22.0	8.3	94.2	1.4	43	7.2	25	58	
" "	"	"	" 13	1,830	25.0	7.5	89.2	1.7	240	7.4	235	49	
" "	"	"	" 19	1,540	24.5	7.4	87.1	1.3	240	7.3	195	71	
" "	"	"	" 27	466	22.0	7.8	88.7	0.9	7	7.2	23	78	
" "	"	"	July 3	490	22.0	7.8	87.9	0.9	230	7.3	98	60	
" "	"	"	" 11	207	26.5	9.2	112.4	2.1		7.4	12	117	
" "	"	"	" 17	169	24.0	8.2	96.4	1.4	9	7.4	17	50	
" "	"	"	" 25	1,470	27.5	6.5	80.8	2.9	93	7.5	290	100	
" "	"	"	" 31	143	28.5	6.6	83.8	1.1	9	7.4	75	68	
" "	"	"	Aug. 8	400	26.0	6.6	79.8	2.5	24	7.3	83	73	
" "	"	"	" 14	89	28.0	7.2	91.0	1.8	9	7.7	17	139	
" "	"	"	" 22	100	23.5	9.7	112.5	2.2	4	7.3	12	85	

TABLE H-7 HOCKING RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth		Date 1940		Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliform M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
							p.p.m.	% Sat.						
Hocking River Hockingport, Ohio	Ho	0.1	Aug.	28	1,940	24.0	7.0	82.3	1.9	460	7.1	255	93	
" "	"	"	Sept.	5	337	21.0	7.9	87.7	0.5	23	6.9	21	67	
" "	"	"	"	11	2,610	20.5	8.7	95.3	1.8	24	6.9	18	100	

* Seeded and Neutralized

** Less than one

KANAWHA RIVER BASIN

Final Report to the Ohio River Committee

Ohio River Pollution Survey

U. S. Public Health Service
Cincinnati, Ohio
1942

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KANAWHA RIVER BASIN

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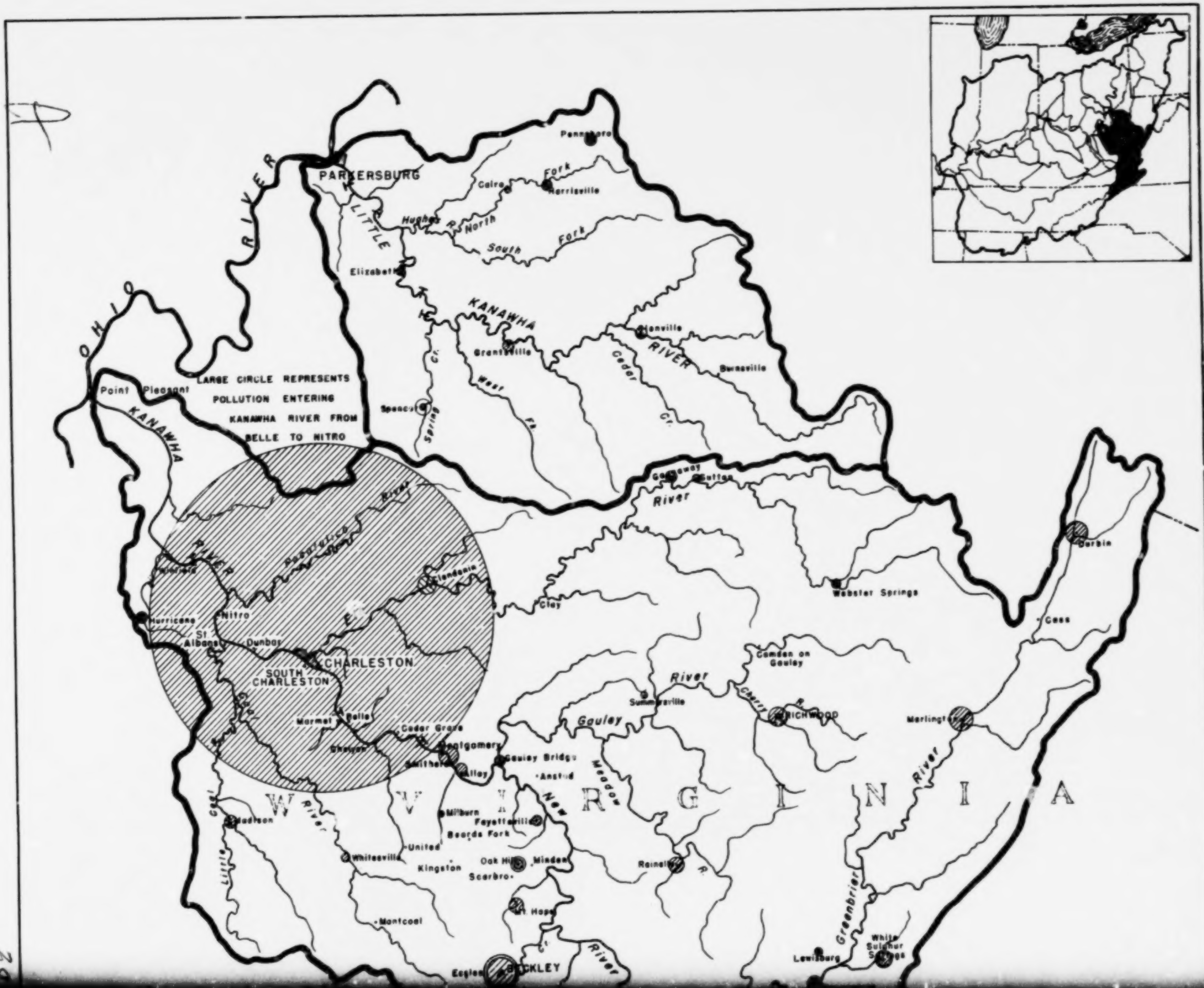
LARGE CIRCLE REPRESENTS
POLLUTION ENTERING
KANAWHA RIVER FROM
BELLE TO NITRO
OHIO
RIVER
Point Pleasant
KANAWHA
PARKERSBURG
LITTLE
KANAWHA
RIVER
Pennsboro
Harrisville
Cairo
North
Fork
South
Fork
Hughes R.
Elizabeth
Grantsville
Glenville
Burnsville
West
Fk.
Cedar
Cr.
Spencer
Spring
Cr.
Gassaway
Sutton
River
Elk
Clendenin
Clay
Webster Springs
Coalton
Hurricane
Nitro
St. Albans
Dunbar
CHARLESTON
SOUTH CHARLESTON
Marmet
Belle
Coal
Cedar Grove
Montgomery
Smithers
Valley
Gauley Bridge
Ansted
Gauley
River
Summersville
Camden on Gauley
Cherry
R.
RICHWOOD
Meadow
New
River
Fayetteville
Milburn
Beards Fork
United
Kingston
Oak Hill
Minden
Scarbro
Mt Hope
Madison
Little
Coal
Whitesville
Montcoal
Eccles
BECKLEY
Rainelle
R.
Greenbrier
River
Lewisburg
White Sulphur Springs
Marlinton
Cass
Durbin
W V I R G I N I A

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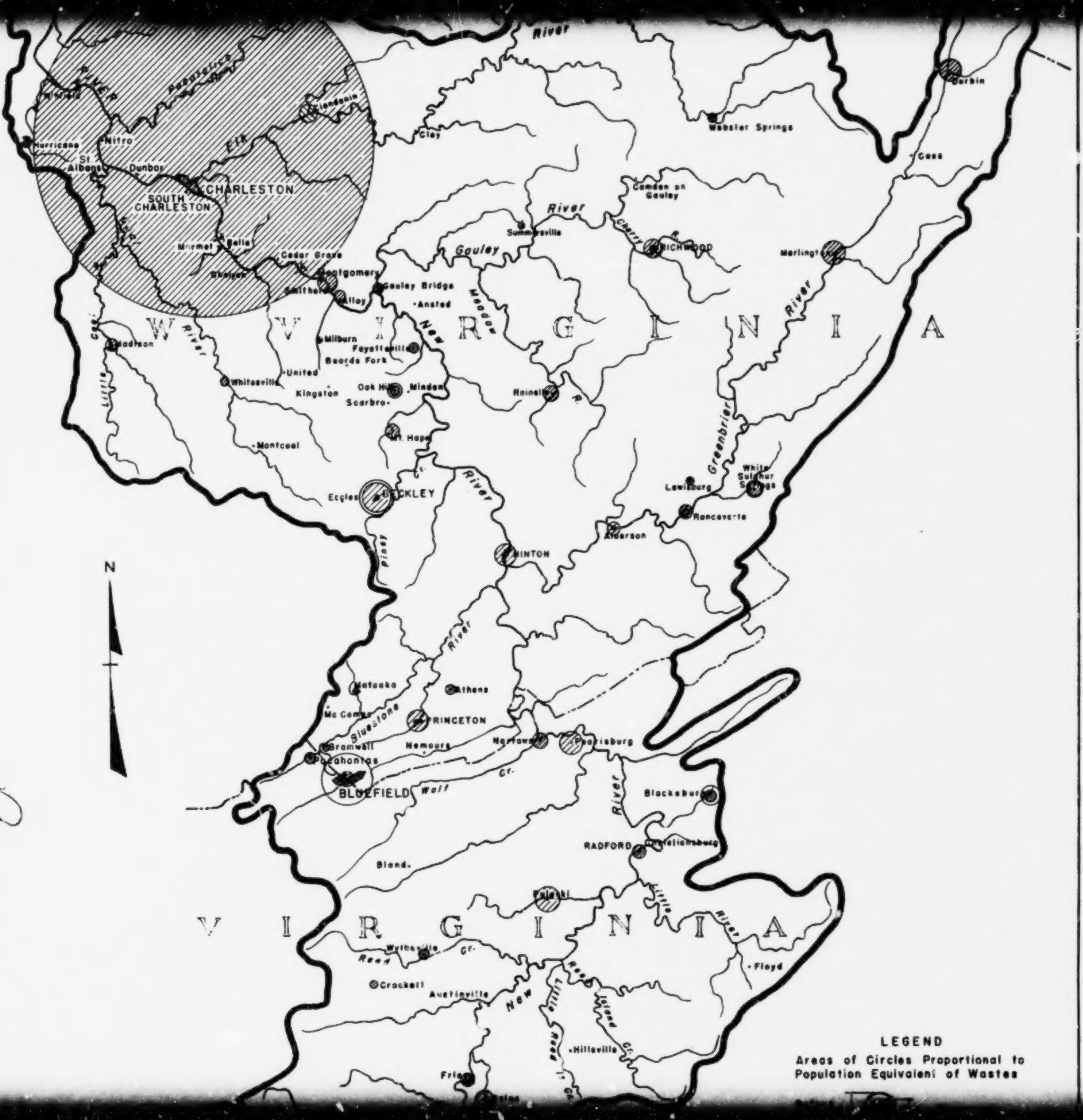
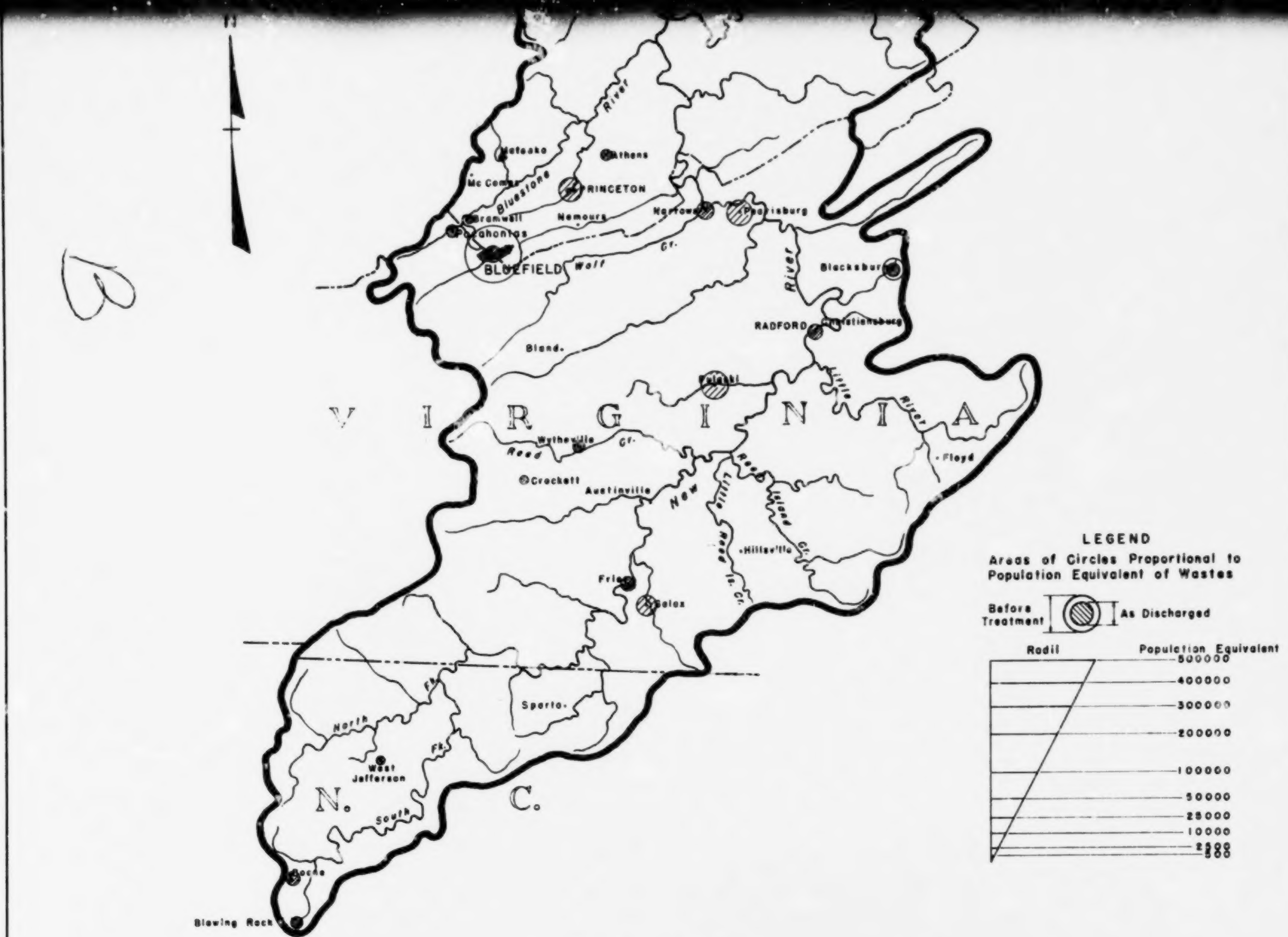

W. VIRGINIA
VIRGINIA
N
River
Pocatalico
Elk
Coal
Little
Clay
Gauley
Meadow
New
Cherry
R.
Greenbrier
River
Piney
Bluestone
Wolf
Cr.
Reed
Little
Island
Hurricane
St. Albans
Nitro
Dunbar
CHARLESTON
SOUTH CHARLESTON
Marmet
Belle
Cedar Grove
Montgomery
Smithers
Gauley Bridge
Ansted
Madison
Milburn
Fayetteville
Boards Fork
United
Whitesville
Kingston
Oak Hill
Minden
Scarbro
Mt. Hope
Montcoal
Eccles
BECKLEY
HINTON
Summersville
Camden on Gauley
RICHWOOD
Webster Springs
Durbin
Cass
Marlinton
Rainelle
Lewisburg
White Sulphur Springs
Ronceverte
Alderson
Athens
Matoaka
Mc Comas
PRINCETON
Bramwell
Pocahontas
BLUEFIELD
Nemours
Narrows
Pearisburg
Blacksburg
RADFORD
Christiansburg
Bland
Pulaski
Wytheville
Crockett
Austinville
Hillsville
Floyd
Fries

LEGEND
Areas of Circles Proportional to
Population Equivalent of Wastes

B

Fig. K-1


LEGEND
Areas of Circles Proportional to Population Equivalent of Wastes
Before Treatment
As Discharged
Radii
Population Equivalent
500000
400000
300000
200000
100000
50000
25000
10000
2500
500
VIRGINIA
N. C.
Matoaka
Athens
McComas
Bluestone
PRINCETON
Bramwell
Nemours
Pocahontas
Narrows
Pearisburg
BLUEFIELD
Wolf
Cr.
River
Blacksburg
RADFORD
Christiansburg
Bland.
Pulaski
Little
River
Wytheville
Reed
Cr.
Floyd
Crockett
Austinville
New
Little Reed Is. Cr.
Reed Island Cr.
Hillsville
Fries
Galax
Sparta
North
Fk.
West Jefferson
South
Fk.
Boone
Blowing Rock

B

KANAWHA—LITTLE KANAWHA BASINS

SOURCES OF POLLUTION

10 0 10 20
SCALE OF MILES

OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941

KANAWHA RIVER BASIN

Syllabus and Conclusions

Syllabus

The Kanawha River drains 12,300 square miles of mountainous country in West Virginia, Virginia and North Carolina. The area is rather sparsely settled except in the rapidly developing industrial area along the Kanawha River in the vicinity of Charleston, W.Va. About 20 percent of the total basin population of 835,000 is urban and about one-sixth of the total population is in the metropolitan area of Charleston. Chemical plants in this section are the principal sources of pollution. Wastes from these and other industries and the untreated domestic sewage from Charleston and its satellites account for more than 90 percent of the pollution load in the basin. As a result, in part, of the Ohio River Pollution Survey, working in cooperation with the State Water Commission and the State Health Department, studies are being made by the industries to determine the most practicable methods for abating this pollution and limited corrective measures have already been taken. Acid mine drainage damages a number of the tributary streams in West Virginia, particularly those south of the Kanawha and New Rivers.

Most of the streams outside the Charleston area are relatively clean and, except in a few places, can be maintained in excellent condition by the adoption of available methods of waste treatment. This is particularly desirable because of the extensive use of the streams for recreation. Low-flow augmentation by reservoirs above Charleston would be a valuable supplement to waste treatment and recovery practices in correcting the organic constituents of the heavy industrial pollution in the Charleston area. Taste and odor characteristics will be improved to a lesser extent. Increased flow in the Elk River is desirable to insure the adequacy of Charleston's water supply.

The pollution abatement program in the Charleston area will involve sewage treatment and industrial waste correction. Because of the technical and often secret nature of the industrial processes involved, industrial pollution corrective measures are squarely up to the industries themselves.

Conclusions

(1) Sixty-five of the 180 public water supplies in the basin are from surface sources. Thirty-three of these, serving more than 150,000 people, are from streams subject to pollution.

(2) Sewage from more than 225,000 people and industrial wastes equivalent to sewage from an additional 1,490,000 enter the streams of the basin. Less than 25 percent of the municipal sewage is treated prior to its discharge.

(3) Laboratory studies indicate that except for the Kanawha in and below the Charleston area the larger streams are relatively clean. Several bad local situations were found on small tributaries.

(4) The major pollution problem in the basin, the reduction of industrial pollution in the Charleston area, is being studied by the industries and limited indicated corrective measures have already been taken. For several of the larger industries, this is a recent development resulting, in part from studies by the Ohio River Pollution Survey working in conjunction with the State of West Virginia.

(5) Primary treatment of domestic sewage will be sufficient to maintain satisfactory conditions on the larger streams except in the Charleston area. More refined treatment cannot be justified in this area.

(6) Secondary treatment is justified at a number of the communities on small streams such as Princeton, Richwood, Pulaski, Wytheville, and White Sulphur Springs. The streams at these places are subject to extremely low flows.

(7) Low-flow augmentation by proposed flood-control reservoirs would improve conditions in the Charleston area. The Bluestone Reservoir, now under construction, will be particularly valuable because of the large increase in flow which it could provide.

(8) Because of the uncertainties in regard to details of reducing industrial pollution in the Charleston area, estimates of the cost of pollution abatement may be subject to correction. The following summary from Table K-1 includes $1,270,000 for the capital cost and $240,000 for annual operation costs of industrial waste control, the bulk of which would be taken by the chemical plants around Charleston.

Treatment	Capital Cost	Annual Charges
Existing	$1,300,000	$115,000
Suggested additional	6,270,000	815,000

Estimated additional costs, over existing charges, of programs involving uniform treatment throughout the basin are:

Primary, all places	$5,890,000	$770,000
Secondary, all places	7,190,000	890,000

Table K-1 Kanawha River Basin - Estimated Cost of Existing and Suggested Minimum Corrective Measures for Sewage and Industrial Wastes, with Comparative Costs for Primary and Secondary Treatment.

	Number of Plants Prim.	Number of Plants Sec.	Population Connected to Sewers	Capital Investment (Dollars)	Annual Charges (Dollars) Amort. & Interest	Annual Charges (Dollars) Operation & Main.	Annual Charges (Dollars) Total
Existing Sewage Treatment	6	6	49,500	1,300,000	80,000	35,000	115,000
Suggested Minimum Correction							
Sewage Treatment Plants	35	16	164,400	2,470,000	175,000	115,000	290,000
Required Interceptors		-	-	2,530,000	120,000	-	120,000
Independent Industrial Waste Correction				1,270,000	165,000	240,000	405,000
Total				6,270,000	460,000	355,000	815,000
Comparative Cost							
Primary Treatment All Waste				5,890,000	430,000	340,000	770,000
Secondary Treatment All Waste				7,190,000	520,000	370,000	890,000
As Suggested				6,270,000	460,000	355,000	815,000

Description

The Kanawha River is formed by the confluence of the New and Gauley Rivers at Gauley Bridge, West Virginia, and flows in a northwesterly direction 97 miles to its junction with the Ohio at Point Pleasant, West Virginia. It drains 12,300 square miles of mountainous country, of which 8,450 are in West Virginia, 3,080 in Virginia and 770 in North Carolina. The principal tributaries are:

Tributary	Distance above Mouth of Kanawha	Drainage Area Square Miles
Elk River	58	1,540
Gauley River	97	1,440
New River	97	6,920
Greenbrier River*	161	1,500

Seventeen municipalities in the basin have more than 2,500 population. Eleven are in West Virginia and the other six in Virginia. The populations of the larger communities and of the entire basin are shown below:

Principal Cities	Population			
	1910	1920	1930	1940
Charleston, W.Va.	22,996	39,608	60,408	67,914
Bluefield, W.Va.	11,188	15,282	19,339	20,641
Beckley, W.Va.	2,161	4,149	9,357	12,852
S.Charleston,W.Va.	-	3,650	5,904	10,377
Pulaski, Va.	5,317	5,282	7,168	8,792
Princeton, W.Va.	3,027	6,224	6,955	7,426
Radford, Va.	4,202	4,627	6,227	6,990
Hinton, W.Va.	3,656	3,912	6,654	5,815
Dunbar, W.Va.	-	-	4,189	5,266
Richwood, W.Va.	3,061	4,331	5,720	5,051
Entire Basin				
Rural	468,296	515,079	580,191	659,327
Urban	56,501	98,180	147,858	175,518
Total	524,797	613,259	728,049	834,845

---

* Tributary of New River.

The biggest concentration of population is in the Kanawha Valley in the vicinity of Charleston, West Virginia. Three of the above communities (Charleston, South Charleston and Dunbar) are in this area which has developed recently as a major organic chemical manufacturing center. Coal mining is an important industry, the most important coal fields being south of the Kanawha and New Rivers in West Virginia adjacent to the Guyandot and Big Sandy Basins. In the western part of the basin, oil, gas and salt brines are produced. Agriculture is handicapped by the lack of level land except in the stream valleys. Forestry, formerly an important occupation, has decreased in importance due to the lack of forest conservation practices. Reforestation is now in progress on some of the timberland.

Water Uses - The lower 91 miles of the Kanawha have been made navigable for boats of 9-foot draft by the construction of three locks and dams. In 1939 about 4,000,000 tons of freight moved on the river. Traffic has increased steadily since the completion of the 9-foot project in 1935.

There are 10 hydroelectric developments on the Kanawha and New Rivers, the most important ones being near Byllesby, Va. (mile 295), Radford, Va., and Gauley Bridge, W.Va. There are also some small water power developments on tributaries. The Kanawha and New Rivers are among the best power streams in the Ohio Basin.

A number of reservoirs have been studied by the U.S. Engineer Department in connection with the authorized program for Ohio River flood control and one project, the Bluestone Reservoir, is under construction. This reservoir, on the New River above Hinton, would aid in flood control in the Kanawha Valley and, in addition, could provide a considerable amount of power and an increase in flow of more than 600 c.f.s. during low-flow periods.

A large part of the basin is well suited for recreational uses. The New and most of its tributaries, in Virginia and North Carolina; the Greenbrier, the Gauley, the Elk and the Coal in West Virginia are all used extensively for fishing, swimming and boating. There are a number of excellent trout streams. Use of the lower Kanawha River is limited almost entirely to boating because of gross pollution in the vicinity of Charleston.

Presentation of Field Data

Figure K-1 shows the location and magnitude of the more important sources of pollution in the basin. Figure K-2 shows similar data and, in addition, the location of water supply intakes from polluted streams and laboratory data on coliform organisms, dissolved oxygen and B.O.D.

Public Water Supplies - There are 180 public water supplies in the basin which serve more than 325,000 people. Sixty-five of these are from surface sources and about half of these are from streams subject to pollution. Table K-2 shows data on the surface supplies of the basin. Four of these supplies, those at Charleston, Belle, St. Albans and Nitro, are owned by one company and are interconnected. They serve almost all of the communities in the most densely populated portion of the basin.

The drought of 1930 caused serious damage to the quality of the Charleston water supply. An epidemic of approximately 9000 cases of acute gastroenteritis occurred. During this time, septic conditions prevailed in the Elk River near the waterworks intake due to decomposing garbage and sewage. Bacteriological examinations of the filter plant effluent at the time showed the supply to be meeting the U. S. Treasury Department drinking water standards. The Charleston supply has an emergency intake in the Kanawha River which was installed at that time and has not been used since.

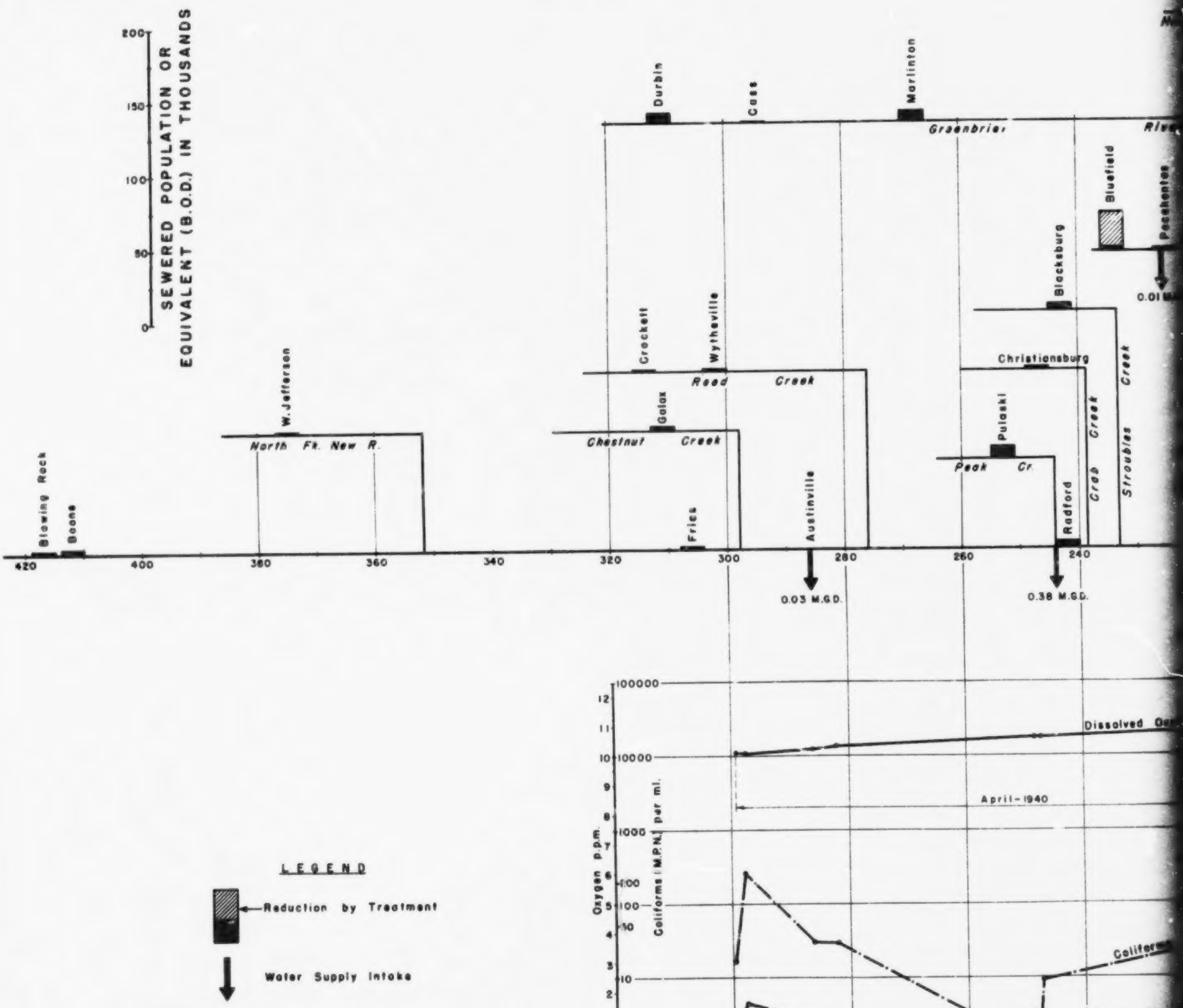
The St. Albans supply from Coal River is affected at times by backwater from the Kanawha. The chemical quality of the surface water supplies of the basin is generally good. In addition to serving as a source of municipal water, the Kanawha River furnishes more than 800 m.g.d. for industrial uses.

Sewerage - Slightly more than 225,000 people in the Kanawha Basin are served by sewers, almost 200,000 of whom are in West Virginia. About one-half of all the sewage comes from towns along the Kanawha River. Less than one-quarter of the sewage receives treatment prior to discharge. Two of the larger communities, Bluefield and Beckley, have recently installed sewage treatment plants.

Table K-2 Kanawha River Basin - Surface Water Supplies

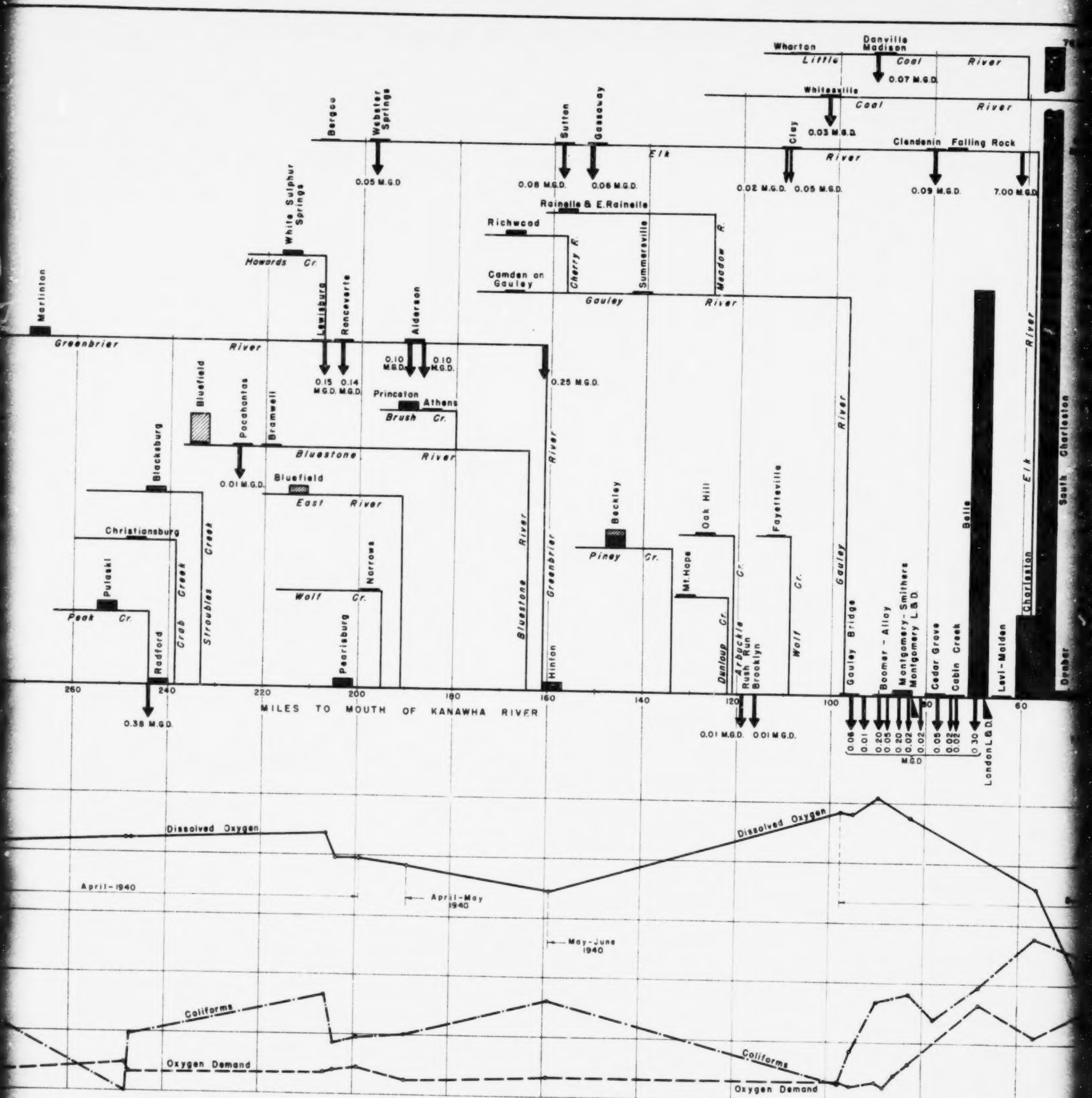
Supply	State	Source	Mile (1)	Treat-ment (2)	Popu-lation Served	Cons. M.G.D.
Supplies Below Community Sewer Outfalls						
Winfield	W.Va.	Kanawha River	32.3	FD	300	0.01
Nitro	"	" "	44.2	FD	11,500	1.50
Belle	"	" "	69.6	FD	9,000	0.30
Chelyan	"	" "	73.6	FD	800	0.02
Cabin Creek	"	" "	74.5	FD	100	0.01
Cedar Grove	"	" "	77.5	FD	1,600	0.05
Pratt	"	" "	81.0	FD	400	0.02
Hendley	"	" "	83.3	F	500	0.02
Montgomery	"	" "	85.4	FD	3,200	0.20
Harewood	"	" "	88.0	FD	1,000	0.05
Alloy	"	" "	89.7	FD	1,600	0.20
Charlton Hgts.	"	Kanawha-Small Str.	93.0	FD(3)	100	0.01
Glen Ferris	"	Kanawha River	95.6	FD	400	0.06
Brooklyn	"	New River	116	D	500	0.01
Rush Run	"	" "	119	D	200	0.01
Radford	Va.	" "	244	FD	7,000	0.38
Austinville	"	" "	286	FD	400	0.03
St. Albans	W.Va.	Coal River	46.4	FD	5,500	0.25
Whitesville	"	" "	102	D	800	0.03
Madison	"	Pond Fk. Coal R.	92.1	FD	2,200	0.07
Charleston	"	Elk R.-Kanawha R.	61.4	FD	85,000	7.00
Clendenin	"	Elk River	79.2	FD	1,300	0.09
Clay	"	" "	110.5	FD	600	0.05
Dundon	"	" "-Impounded	110.5	FD	100	0.02
Gassaway	"	" "	152	FD	1,400	0.06
Sutton	"	" "	158	FD	1,300	0.08
Addison	"	" "-Small Str.	197.5	FD	1,300	0.05
Hinton	"	Greenbrier-New R.	161.5	FD	7,000	0.25
Alderson (Fed.Inst.)	"	Greenbrier River	187	FD	700	0.10
Alderson	"	" "	190	FD	1,700	0.10
Ronceverte	"	" "	204	FD	2,300	0.14
Lewisburg	"	" "	208	FD	1,800	0.15
Nemours	"	Bluestone River	225.5	FD	100	0.01
Total - Below Sewer Outfalls					151,700	11.33
32 Other Surface Supplies					49,800	3.76
Total - Surface Water Supplies					201,500	15.09

(1) Miles from mouth of Kanawha River.
(2) F - Coagulated, settled, filtered. D - Chlorinated.
(3) Filtered, no coagulants.



A

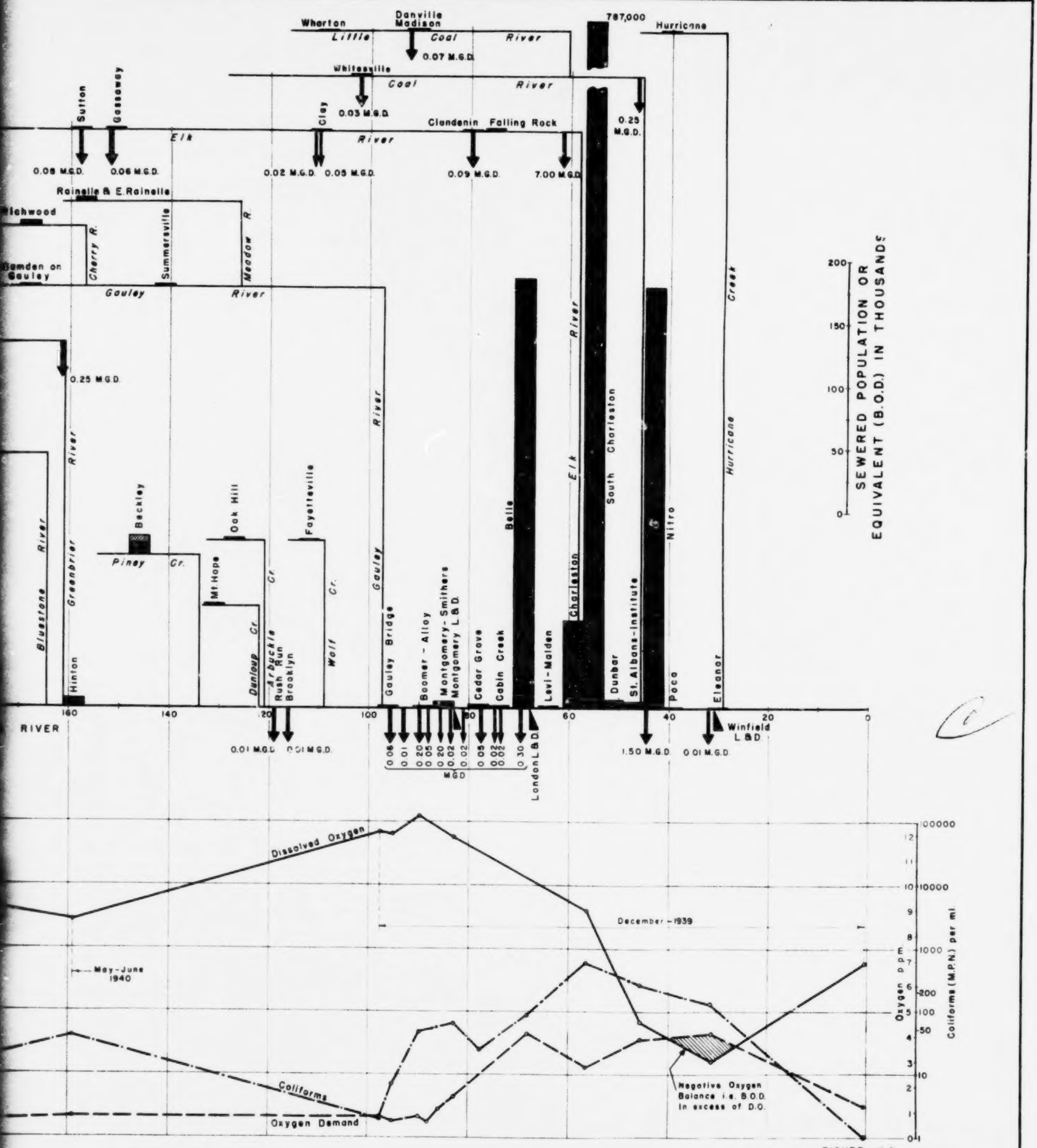
OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941


Wharton
Danville
Madison
Little Coal River
0.07 M.G.D.
Whitesville
Coal River
0.03 M.G.D.
Bergoo
Webster Springs
0.05 M.G.D.
Sutton
Gassaway
Elk River
Clay
Clendenin
Falling Rock
0.08 M.G.D.
0.06 M.G.D.
0.02 M.G.D.
0.05 M.G.D.
0.09 M.G.D.
7.00 M.G.D.
Rainelle & E. Rainelle
Richwood
Cherry R.
Meadow R.
Summersville
Camden on Gauley
Gauley River
White Sulphur Springs
Howards Cr.
Marlinton
Greenbrier River
Lewisburg
Ronceverte
Alderson
0.15 M.G.D.
0.14 M.G.D.
0.10 M.G.D.
0.10 M.G.D.
0.25 M.G.D.
Princeton
Athens
Brush Cr.
Bluefield
Pocahontas
Bramwell
Bluestone River
0.01 M.G.D.
Bluefield
East River
Blacksburg
Christiansburg
Pulaski
Peak Cr.
Crab Creek
Stroubles Creek
Radford
Narrows
Wolf Cr.
Pearisburg
Bluestone River
Greenbrier River
Hinton
Beckley
Piney Cr.
Oak Hill
Mt. Hope
Dunloup Cr.
Arbuckle Cr.
Fayetteville
Wolf Cr.
Rush Run
Brooklyn
Gauley River
Gauley Bridge
Boomer - Alloy
Montgomery-Smithers
Montgomery L&D.
Cedar Grove
Cabin Creek
Belle
Levi-Malden
Charleston
Elk River
South Charleston
Dunbar
260
240
220
200
180
160
140
120
100
80
60
MILES TO MOUTH OF KANAWHA RIVER
0.38 M.G.D.
0.01 M.G.D.
0.01 M.G.D.
0.06
0.01
0.20
0.05
0.20
0.02
0.02
0.05
0.02
0.02
0.30
M.G.D.
London L&D.
Dissolved Oxygen
Dissolved Oxygen
April-1940
April-May 1940
May-June 1940
Coliforms
Coliforms
Oxygen Demand
Oxygen Demand

B

396 W

FIG. K-2



C

FIGURE - K 2

KANAWHA RIVER

SOURCES OF POLLUTION
AND
SELECTED LABORATORY DATA

B

Table K-3 Kanawha River Basin - Sources of Pollution, Including Industrial Wastes, Expressed as Sewered Population Equivalent (B.O.D.).

Municipality	State	Receiving Stream	Mile (1)	Population Connected to Sewers	Treatment	Sewered Population Equivalent (B.O.D.) Untreated	Sewered Population Equivalent (B.O.D.) Discharged
Nitro	W.Va.	Kanawha River	43	4,000	None	334,000	334,000
St. Albans	"	" R.- Coal R.	46	4,000	"	4,000	4,000
Dunbar	"	" River	52	5,200	"	5,200	5,200
So. Charleston	"	" "	54	9,000	"	787,000	787,000
Charleston	"	" R.- Elk R.	58	70,000	"	70,000	70,000
Belle	"	" River	70	1,400	"	338,400	338,400
Montgomery	"	" "	85	3,200	"	3,200	3,200
Hinton	"	New R.-Greenbrier R.	159	6,700	"	6,700	6,700
Narrows	Va.	" " -Wolf Creek	197	300	"	2,900	2,900
Pearisburg	"	" River	203	400	"	7,000	7,000
Radford	"	" "	242	2,100	"	3,800	3,800
Boone	N.C.	Winkler Creek	412	2,200	"	3,100	3,100
Falling Rock	W.Va.	Elk River	75	-	-	2,700	2,700
Richwood	"	Cherry River	168	4,200	None	4,200	4,200
Beckley	"	Piney Cr.-Little Whitestick Creek	146	14,500	Pri.	14,600	9,500
White Sulphur Springs	"	Howards Creek	215	2,800	"	2,800	1,800
Marlinton	"	Greenbrier River	268	1,600	None	7,500	7,500
Durbin	"	" "	311	500	"	6,700	6,700
Princeton	"	Brush Creek	190	6,500	"	6,600	6,600
Bluefield	"&Va.	Bluestone River	234	19,500	Sec.	26,000	2,200
Bluefield	W.Va.	Grassy Br. of East R.	213	3,000	"	7,500	400
Blacksburg	Va.	Strubles Creek	243	4,400	"	4,400	2,000
Pulaski	"	Peak Creek	253	5,000	None	8,600	8,600
Galax	"	Chestnut Creek	311	2,400	"	3,800	3,800
95 smaller sources	-	-		53,600	-	56,000	53,800
Total - West Virginia				199,800		1,671,700	1,633,600
Virginia				21,700		38,900	35,700
North Carolina				5,000		6,100	5,800
Total Basin				226,500		1,716,700	1,675,100

(1) Miles above mouth of Kanawha River.

Industrial Wastes - Table K-4 summarizes data on the sources of industrial wastes by type of industry and method of disposal. The population equivalent of the industrial wastes amounts to more than six times that of the sewage and all but about three percent of this load is discharged to the Kanawha River in the 25-mile stretch from Belle to Nitro (the Charleston metropolitan area).

In addition to these industries, there are 24 coal washeries, most of which have recirculating systems but from which varying amounts of fine coal particles escape causing turbidity and culm deposits in the streams.

Table K-4 Kanawha River Basin - Summary of Industrial Wastes not Discharged to Municipal Treatment Plants, with Total of Entire Industrial Waste Load in the Basin

Industry	Number of Plants	Industrial Waste Disposal		At Least Minor Corrective Measures Taken	Estimated Sewered Population Equivalent (B.O.D.)
		Munic. Sewers	Private Outlets		
Canning	2	-	2	1	1,600
Chemical	11	3	8	4	1,378,000
Milk	2	-	2	2	200
Oil Refining	2	-	2	2	3,600
Tanning	3	-	3	3	18,700
Textile	9	3	6	2	8,300
Miscellaneous	36	0	36	17	68,700
Wastes Unconnected Munic. Treatment	65	6	59	31	1,479,100
Waste Connected to Municipal Treatment					11,100
Total Industrial Waste in Basin					1,490,200

Acid Mine Drainage - Prior to the mine sealing program some 33,000 tons of acid were discharged each year from about 950 mines. Mines producing about two-thirds of this acid have been sealed and the total acid load has been reduced by more than 40 percent. The acid from unsealed mines comes largely from active mines which discharge more than 9,000 tons per year. Most of the acid-producing mines are in the area drained by the Bluestone and along the small tributaries of the Kanawha and New Rivers in West Virginia.

Presentation of Laboratory Data

Table K-7 summarizes the results of the laboratory observations in the Kanawha Basin. Table K-5 shows selected laboratory data on the main stream and tributaries. All samples from the Kanawha Basin were collected and analyzed by a mobile laboratory unit except for those samples at the mouth, which were collected and analyzed at the Kiski Laboratory at Ashland. The various sampling periods involved in studying this basin were as follows:

Area	Period	Laboratory Unit
Mouth	Aug.,1939 to Apr.,1940	Kiski
Gauley Bridge to Mouth	Dec.,1939 to March 1940	Trailer
New, Gauley & Greenbrier	April to June, 1940	"
Taste and odors-Charleston	Dec.,1939 to Jan.,1940	"
" " " "	Dec.,1940 to Feb.,1941.	"

From one to four stream samples were collected and analyzed from each sampling point reached by a trailer unit and from four to nine samples monthly were obtained at the mouth during the nine-month period of sampling from the Kiski. Discharges were generally low during the periods from August, 1939, to February, 1940, and from December, 1940 to February, 1941. Medium high to high discharges prevailed from March to May, 1940.

Figures K-3, K-4 and K-5 show graphically the coliform, dissolved oxygen and oxygen demand results. In the vicinity of Charleston and at the mouth, where the results were obtained over a period of months, the results shown on these spot maps represent the most unfavorable monthly averages. All other results represent the averages of the series of one to four samples collected at each point by a mobile unit over periods of less than one month.

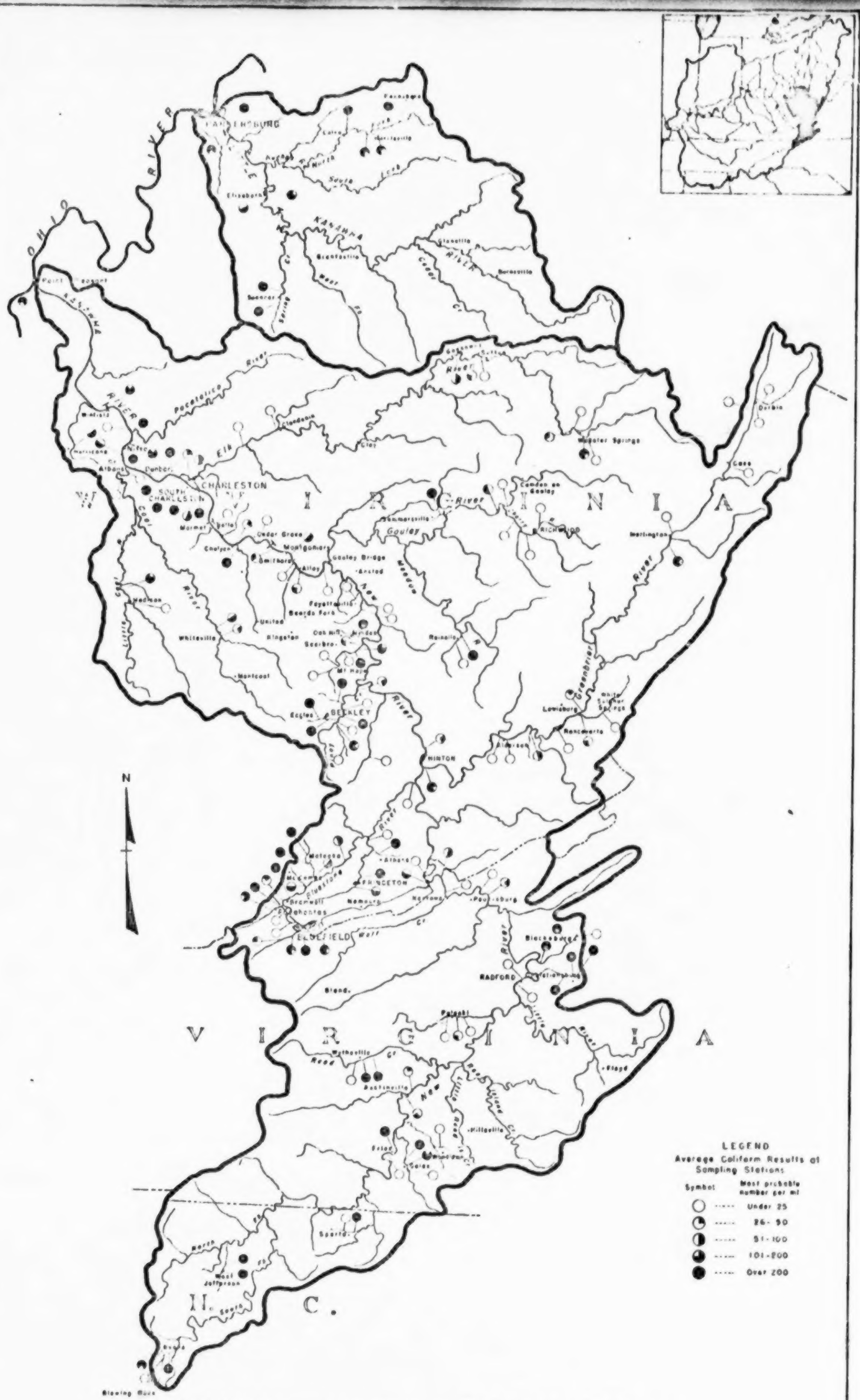
From these results it appears that the larger streams of the Kanawha Basin are not seriously polluted except in the 40-mile stretch below Charleston. Bad localized conditions exist on the tributaries of the New River below Boone, West Jefferson, Wytheville, Pulaski, Christiansburg, Blacksburg, Bluefield, Pocahontas and Beckley. The Greenbrier, Gauley and Elk Rivers above Charleston are in relatively good sanitary condition. Gas, oil and refinery wastes produce taste and odor problems along the Elk River.

Acid stream conditions were observed in the vicinity of Pulaski, Virginia, on Peak Creek and along Piney and Beaver Creeks near Beckley, W.Va., and along Dunloup Creek at Mt. Hope. At Pulaski the acidity is due to wastes from a chemical plant while at the other points it is caused by mine drainage. The pH's of these streams ranged from 3.0 to 5.9 and phenolphthalein acidities from about 10 to more than 125 p.p.m.

In collaboration with the West Virginia Department of Health and the State Water Commission, a survey of taste and odor problems along the Kanawha and Elk Rivers, with particular reference to the problems existing in the Charleston area, was carried out in the winter of 1939-40 and again in 1940-41. Threshold odor examinations were made of the river waters at stations above, in and below Charleston and of certain industrial wastes. These results show a marked increase in the threshold odor number of Kanawha River water in the vicinity of the Marmet Locks and Dam. Values of 300 to 400 were observed at various times at Marmet, Charleston and South Charleston. On the Elk River the threshold odor numbers were generally below 50.

Odor determinations are at best rather crude criteria and are largely dependent upon the observer's ability at detection. Then, too, high intensity transient odors may mask more persistent but less intense troublesome odors. Odor determinations, both before and after storage under standard conditions, have been suggested as a means of eliminating transient odors. The results as a whole indicate that the odors tend to diminish progressively downstream from Charleston on the Kanawha and that odors along the Elk River tend to diminish from Clendenin to the Charleston intake. Threshold odor determinations made on the effluent from several industrial plants in the vicinity of Charleston and on the Elk River gave results ranging from about 500 to 1,000,000 or more. The odor determinations in themselves should serve more as a guide and should be supplemented with other chemical data before drawing too many conclusions from the results. Further treatment of industrial wastes probably will contribute to overcoming the taste and odor problem in this region.

Biological Summary - The flora and fauna of the Kanawha were found to be less than 1,000 p.p.m., which may be due in part to the clean nature of the upper reaches and also the industrial wastes near Charleston and along the Elk River.


PARKERSBURG
OHIO
RIVER
KANAWHA
LITTLE KANAWHA RIVER
Point Pleasant
Elizabeth
Spencer
Hurricane
St. Albans
Dunbar
Elk
CHARLESTON
SOUTH CHARLESTON
Clay
Gauley
River
Richwood
Marlinton
Cass
Durbin
Summersville
Montgomery
Cedar Grove
Madison
Coal River
Whitesville
Beckley
Hinton
Greenbrier
Lewisburg
White Sulphur Springs
Ronceverte
Princeton
Bluefield
Bland
Radford
Blacksburg
Pulaski
Wytheville
Reed Cr.
Floyd
Hillsville
Fries
Sparta
West Jefferson
Blowing Rock
Pocahontas
Narrows
Pearisburg
Wolf Cr.
New River
W.
V I R G I N I A
V I R G I N I A
N. C.
N
LEGEND
Average Coliform Results of Sampling Stations
Symbol
Most probable number per ml
○ ...... Under 25
◔ 26- 50
◑ 51-100
◕ 101-200
● ...... Over 200

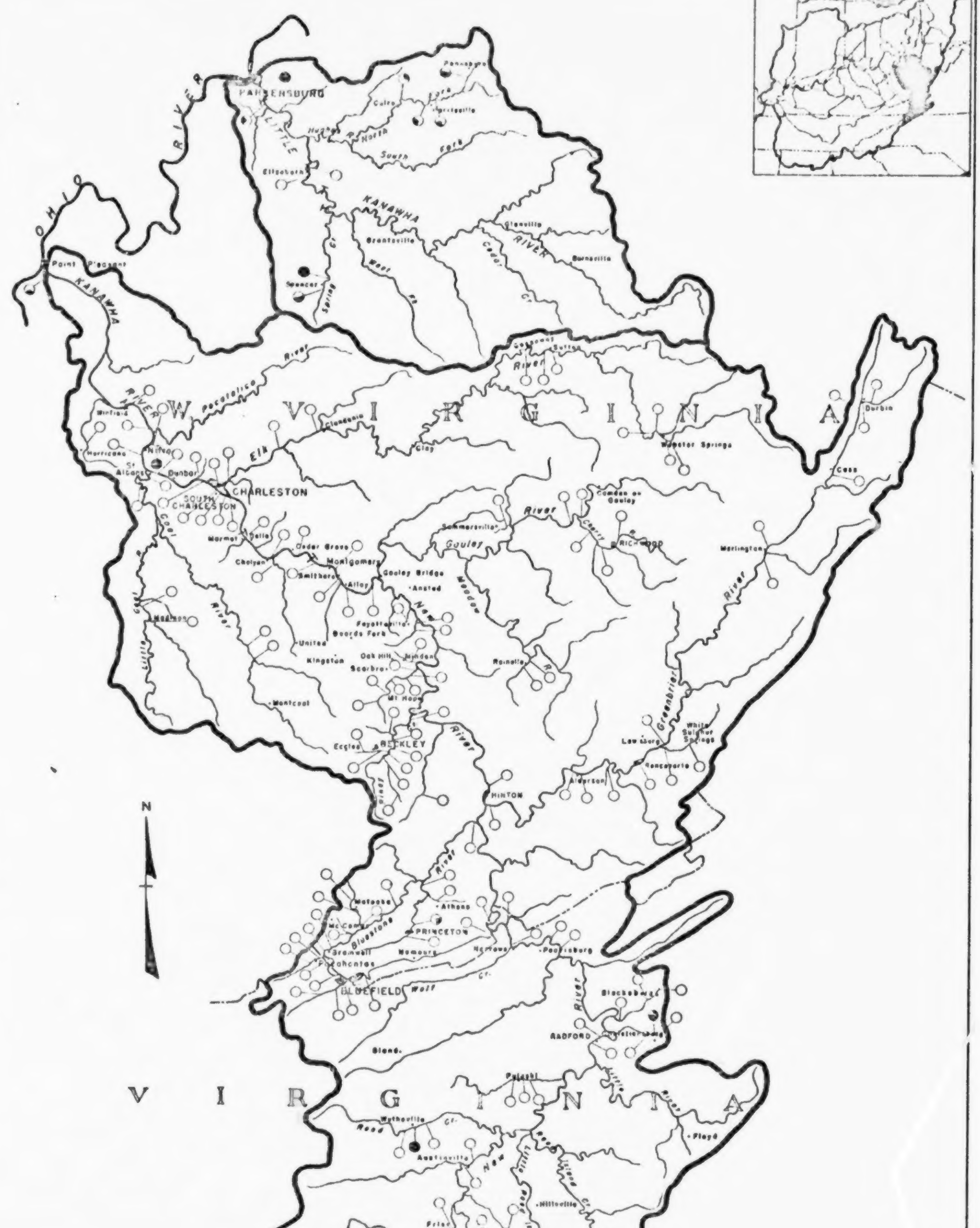
KANAWHA—LITTLE KANAWHA BASINS

COLIFORM RESULTS

10 0 10 20
SCALE OF MILES

OHIO RIVER POLLUTION SURVEY
U S PUBLIC HEALTH SERVICE
1941

Fig. K-3


OHIO RIVER
PARKERSBURG
LITTLE KANAWHA RIVER
Pennsboro
Cairo
Harrisville
Hughes R.
North Fork
South Fork
Elizabeth
Grantsville
Glenville
Burnsville
Cedar Cr.
West Fk.
Spencer
Spring Cr.
Point Pleasant
KANAWHA RIVER
Pocatalico River
W. VIRGINIA
Winfield
Hurricane
Nitro
St. Albans
Dunbar
CHARLESTON
SOUTH CHARLESTON
Elk
Clendenin
Clay
Gassaway
Sutton
Webster Springs
Durbin
Cass
Camden on Gauley
Cherry R.
RICHWOOD
Summersville
Gauley River
Marlinton
Greenbrier River
Coal River
Marmet
Belle
Cabin Creek
Cedar Grove
Montgomery
Gauley Bridge
Ansted
Smithers
Alloy
Fayetteville
Boomer
Madison
Little Coal R.
Boone Fork
United
Kingston
Oak Hill
Mt. Hope
Scarbro
Meadow R.
Rainelle
Montcoal
Eccles
BECKLEY
New River
HINTON
Alderson
Lewisburg
White Sulphur Springs
Ronceverte
Matoaka
Athens
McComas
Bluestone
PRINCETON
Bramwell
Pocahontas
BLUEFIELD
Narrows
Pearisburg
Wolf Cr.
Blacksburg
RADFORD
Christiansburg
Bland
VIRGINIA
Pulaski
Wytheville
Reed Cr.
Austinville
Little River
Floyd
Hillsville
Fries
Galax
Sparta
North Fk.
West Jefferson
South Fk.
N. C.
Blowing Rock
N
LEGEND
Average Dissolved Oxygen
Results at Sampling Stations.
Symbol Dissolved Oxygen p.p.m
○ ----- Over 6.5
◔ ----- 5.1 to 6.5
◑ ----- 3.1 to 5.0
● ----- 3.0 or less

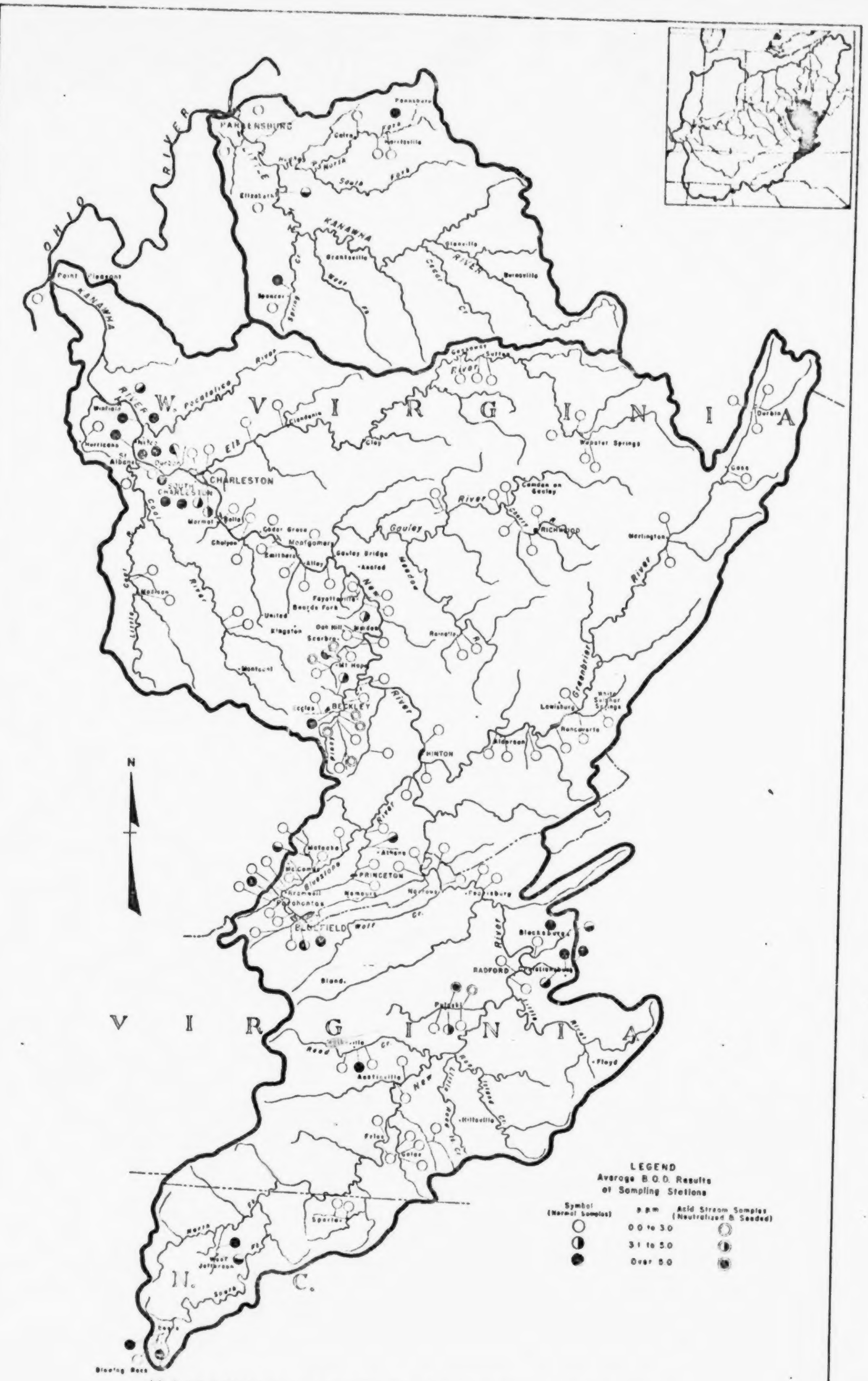
KANAWHA—LITTLE KANAWHA BASINS

DISSOLVED OXYGEN RESULTS

10 0 10 20
SCALE OF MILES

OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941

Fig. K-4


OHIO RIVER
PARKERSBURG
Pennsboro
Cairo
Harrisville
Elizabeth
LITTLE KANAWHA RIVER
Grantsville
Glenville
Burnsville
Spencer
Point Pleasant
KANAWHA RIVER
Pocatalico River
Elk River
W. VIRGINIA
Winfield
Hurricane
Nitro
St. Albans
Dunbar
Clendenin
Clay
Gassaway
Sutton
Webster Springs
Durbin
Cass
CHARLESTON
SOUTH CHARLESTON
Marmet
Belle
Cedar Grove
Chelyan
Montgomery
Smithers
Gauley Bridge
Gauley River
Camden on Gauley
Richwood
Marlinton
Madison
Coal River
Fayetteville
Beards Fork
United
Oak Hill
Kingston
Scarbro
Mt Hope
Montcoal
Eccles
BECKLEY
HINTON
Ronceverte
Lewisburg
White Sulphur Springs
Alderson
Greenbrier River
New River
Athens
PRINCETON
Matoaka
McComas
Bluestone
Pocahontas
Bramwell
Narrows
Pearisburg
BLUEFIELD
Wolf Cr.
Bland
Blacksburg
RADFORD
Christiansburg
Pulaski
VIRGINIA
Reed Cr.
Austinville
Floyd
Hillsville
Galax
Sparta
West Jefferson
N. C.
Blowing Rock
LEGEND
Average B.O.D. Results
of Sampling Stations
Symbol (Normal Samples) p.p.m. Acid Stream Samples (Neutralized & Seeded)
○ 0.0 to 3.0 ○
◐ 3.1 to 5.0 ◐
● Over 5.0 ●
N

KANAWHA—LITTLE KANAWHA BASINS

BIOCHEMICAL OXYGEN DEMAND

10 0 10 20
SCALE OF MILES

OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941

Fig. K-5

400 l

Table K-5 Kanawha River Basin - Selected Laboratory Data.

River Location	Kanawha near Mouth	Kanawha U.S.Lock Winfield	Kanawha Bridge St.Albans	Kanawha Patrick St. Bridge Charleston	Kanawha Kanawha City Bridge Charleston	Kanawha U. S. Lock Belle
River Miles Above: Mouth of Kanawha	0.6	31.1	45.6	56.3	60.9	67.7
Period -	12-39	12-39	12-39	12-39	2-41	12-39
Number of Samples	7	3	3	3	2	3
Flow in c.f.s.: Sampling days	3,260	-	-	-	-	-
Water Temperature °C.	5.0	8.7	7.7	6.3	0.8	8.3
Coliforms per ml.	*	124	257	577	29	72
Dissolved Oxygen ppm.	6.9	3.0	4.6	9.0	12.6	10.2
B.O.D.,5-day, p.p.m.	1.2	4.1	3.9	2.8	3.2	4.1

River Location	Kanawha U.S. Lock London	Kanawha Bel. Gauley Bridge	New River above Mouth	New River Bridge at Hinton	New River below Narrows	New River abv.Pearisburg	New River bel.Bridge Radford
River Miles Above: Mouth of Kanawha	82.8	95	97.1	159	199	204	247
Period -	12-39	12-39	12-39	May-June '40	4-40	4-40	4-40
Number of Samples	3	2	2	3	3	2	3
Flow in c.f.s.: Sampling days	-	-	-	13,330	-	3,260	3,170
Minimum Month	-	1,130	1,090	1,090	-	-	940
Water Temperature °C.	6.0	4.0	5.5	18.8	11.2	11.8	9.7
Coliforms per ml.	62	7	2	41	9	7	9
Dissolved Oxygen ppm.	11.9	12.0	12.1	8.6	9.9	9.8	10.6
B.O.D.,5-day,p.p.m.	1.6	0.6	0.8	0.8	1.1	1.0	0.8

River Location	Peak Creek above Pulaski,Va.	Peak Creek below Pulaski,Va.	Stroubles Creek above Blacksburg, Va.	Stroubles Creek below Blacksburg, Va.	Brush Creek above Princeton,W.Va.	Brush Creek below Princeton,W.Va.	Bluestone R. bel.Bluefield,Va.
River Miles Above: Conf.with New River	23.5	22	11	9	27	24.5	69.5
Mouth of Kanawha	268	266.5	244	242	191.5	189	215
Period - 1940	April	April	April	April	Apr. & May	Apr. & May	May
Number of Samples	3	3	3	3	3	3	3
Flow in c.f.s.: Sampling Days	68	68	3	3	3	20	30
Minimum Month	*	*	*	*			
Water Temperature °C.	9.0	10.3	12.8	13.2	14.2	13.7	13.5
Coliforms per ml.	16	26	8	4,740	88	970	11
Dissolved Oxygen ppm.	10.8	8.1	10.1	7.4	9.4	5.5	9.0
B.O.D.,5-day,p.p.m.	0.6	** 7.77	3.4	11.6	0.6	2.4	3.0

River Location	Greenbrier River above Marlinton,W.Va.	Greenbrier River below Marlinton,W.Va.	Piney Creek above Beckley, W.Va.	Piney Creek below Beckley, W.Va.	Cherry River above Richwood, W.Va.	Cherry River below Richwood, W.Va.	Elk River bel.Falling Rock,W.Va.
River Miles Above: Conf.with New River	106.5	103	9.5	9	70	69	16
Mouth of Kanawha	267.5	264	143.5	143	167	166	74
Period -	5&6 - '40	5&6 - '40	5 - '40	5 - '40	1&2 - '40	1&2 - '40	12 - '39
Number of Samples	3	3	3	3	2	2	2
Flow in c.f.s.: Sampling Days	3,800	3,800	18	18	330	330	-
Minimum Month	10	10	-	-	*	*	-
Water Temperature °C.	15.5	16.0	17.0	16.3	0.0	0.0	6.0
Coliforms per ml.	9	125	20	392	1	23	67
Dissolved Oxygen ppm.	9.0	9.1	8.6	8.5	13.4	13.0	10.8
B.O.D.,5-day,p.p.m.	0.6	0.7	** 0.8	** 2.0	1.8	1.2	1.8

* Less than one. ** Acid sample - seeded and neutralized.

Hydrometric Data

More than 50 stream gaging stations have been maintained in the Kanawha Basin at various times and 25 are currently in operation. Table K-6 shows monthly mean summer flows at eight stations for the three driest summers of record at each station. Practically continuous discharge records are available on the Kanawha River at Kanawha Falls (mile 95) for the period since 1877, one of the longest periods of record in the Ohio Basin. Figure K-6 is a low-flow frequency curve for this stream based on the four summer months (June-September inclusive). A second curve, plotted to the same scale, shows similar information for flows regulated by Bluestone Reservoir. It indicates that the frequencies with which various minimum monthly mean summer flows may be expected, both with and without Bluestone Dam regulation, are as follows:

Kanawha R. at Kanawha Falls	Minimum Monthly Mean Summer Flows in Cubic feet per Second that may be expected once in			
	2 Years	5 Years	10 Years	Minimum
Unregulated	3,400	2,320	2,140	1,290
Regulated by Bluestone Res.	4,100	3,120	2,670	2,000

Proposed Stream Control - The following proposed reservoirs in the Kanawha Basin have been studied by the U. S. Engineer Department in connection with the authorized program for Ohio River flood control:

Reservoir	Stream	Maximum Storage acre-ft.	Supplemental Flow Made Available c.f.s.
Poca	Pocatalico R.	202,000	8
Clendenin	Elk River	108,000	70
Birch	Birch River	43,600	29
Summersville	Gauley River	315,000	134
Big Bend	Greenbrier R.	108,500	74
Moores Ferry	New River	1,010,000	Unknown

The supplemental flows shown are those that could be made available by use of a portion of the flood-control storage capacity after the end of the flood season. Low-flow regulation by the Moores Ferry Reservoir would depend largely on possible power operations. Consideration is being given to such operation of the reservoirs.

Table K-6 Kanawha River Basin - Monthly Mean Summer Flows for Years in which Low Summer Flows have Occurred.

River Location	New River at Eggleston, Va.	Kanawha R. Kanawha Falls, W.Va.	Peak Creek at Pulaski, Va.	Bluestone River Lilly, W.Va.
River Miles Above:				
Mouth of Kanawha	217	95	253	168
Drain.Area Sq.Mi.	2,941	8,367	68	438
Period of Record	1915-37	1877-1940	1927-33	1908-16 1920-40
Year	1925	1930	1930	1930
June c.f.s.	1,530	2,550	-	36.4
July "	1,320	1,290	-	27.2
August "	812	1,520	-	26.2
September "	853	1,310	0.8	7.3
Year	1930	1925	1932	1939
June "	1,710	3,370	14.1	319
July "	999	2,660	2.7	182
August "	1,250	1,390	2.3	90.9
September "	1,070	1,340	1.6	26.3
Year	1932	1932	1929	1911
June "	2,660	7,160	221	88.6
July "	1,500	11,300	19.2	132
August "	1,230	2,910	8.2	34.5
September "	1,020	1,340	5.6	40.2

River Location	Greenbrier River Buckeye, W.Va.	Gauley R. Summersville, W.Va.	Elk River Queen Shoals, W.Va.	Coal River, Ashford, W.Va.
River Miles Above:				
Mouth of Kanawha	263	142	84	72
Drain.Area Sq.Mi.	540	680	1,145	393
Period of Record	1929-40	1908-16 1929-40	1929-40	1930-40
Year	1930	1930	1930	1930
June c.f.s.	191	108	128	23.4
July "	27.8	13.3	17.1	6.4
August "	21.5	23.5	13.1	13.4
September "	13.5	7.7	7.2	1.3
Year	1932	1939	1932	1939
June "	264	403	841	196
July "	896	1,330	7,280	121
August ""	75.1	464	570	32.9
September "	35.0	38.7	52.7	8.3
Year	1934	1936	1939	1936
June "	149	90.4	543	19.6
July "	40.6	57.4	1,650	29.6
August "	56.5	78.0	586	36.8
September "	234	56.1	39.4	45.4

Fig. K-6

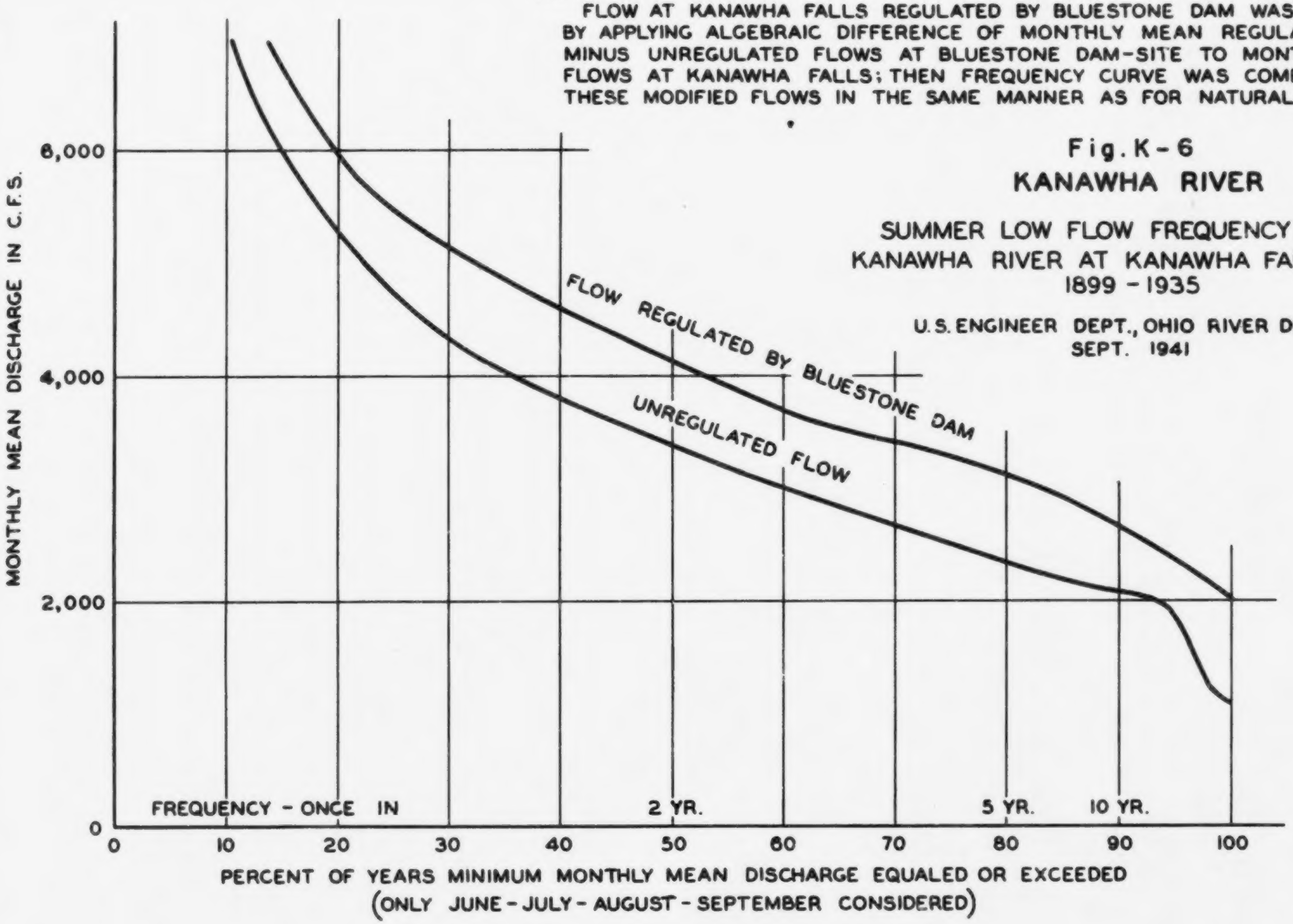
Fig. K-6

KANAWHA RIVER

SUMMER LOW FLOW FREQUENCY CURVES
KANAWHA RIVER AT KANAWHA FALLS, W. VA.
1899 - 1935

U.S. ENGINEER DEPT., OHIO RIVER DIVISION
SEPT. 1941

NOTE-
FLOW AT KANAWHA FALLS REGULATED BY BLUESTONE DAM WAS DETERMINED BY APPLYING ALGEBRAIC DIFFERENCE OF MONTHLY MEAN REGULATED FLOWS MINUS UNREGULATED FLOWS AT BLUESTONE DAM-SITE TO MONTHLY MEAN FLOWS AT KANAWHA FALLS; THEN FREQUENCY CURVE WAS COMPUTED FROM THESE MODIFIED FLOWS IN THE SAME MANNER AS FOR NATURAL FLOWS.



Discussion

The major pollution problems of the Kanawha Basin are in the main Kanawha Valley in the vicinity of Charleston. Problems of lesser importance exist on the Elk River below oil and gas plants and on other streams below moderate sized and small municipalities.

Charleston and Vicinity - In the vicinity of Charleston, the chemical industry discharges large volumes of wastes which constitute a drain on the oxygen resources of the river and cause objectionable tastes and odors in downstream water supplies. In addition to the industrial wastes, sewage from Charleston and other cities along the river is discharged untreated.

Laboratory results during the low-flow period in December, 1939, showed a dissolved oxygen content of 3 p.p.m. in the Kanawha at the Winfield Locks (mile 31.1). This represents a deficiency below saturation of about 8.7 p.p.m. Such a deficiency during the summer would result in the complete exhaustion of all the oxygen in the stream with attendant nuisance conditions and destruction of aquatic life.

Because of the unique character of many of the chemical plants, their rapid growth, and the constant changes in processes and products, methods of accomplishing reduction in the strength or quantity of the wastes must be based on a rather complete study of each plant. Because of the technical and often secret nature of the industrial processes involved, pollution corrective measures are squarely up to the industries themselves. Outside assistance must be confined to determining which effluents are damaging and measuring accomplishments after corrective measures have been taken. The Ohio River Pollution Survey, working with the State of West Virginia, has already located the damaging effluents. Several of the plants have undertaken studies and have instituted new practices designed particularly to reduce the discharge of wastes causing tastes and odors in the water supplies taken from the Kanawha River. Intensified efforts on the part of the industrial research technicians as well as the State enforcement agency are necessary to prevent a steady deterioration in the quality of the lower Kanawha River because of the phenomenal growth of the chemical industry.

The capital cost of remedial or pollution control measures at the large industrial plants is estimated very approximately to be $1,000,000, and the annual operating cost to be $160,000. This estimate is much smaller than the cost of correcting an equivalent amount of organic pollution in the form of domestic sewage, and is more in line with the experience of a limited number of large industries confronted with organic and taste and odor pollution problems. The estimate may be subject to reduction with the development of efficient recovery practices.

Preliminary survey information on pollution loadings in the South Charleston area and river and industrial effluent quality were released to the State and served as a basis for pollution abatement discussion with the industries. As a result, a start toward pollution control has been, and is being, made by the industries. The program is in its early stages and, although a resurvey was made, no improvement of consequence was noted. This is not an adverse result as industrial activity had increased during the period between surveys and greater pollution might have been expected.

Although industrial pollution overshadows sewage pollution in importance on the Kanawha, the municipal wastes from Charleston and vicinity cause heavy bacterial loadings on downstream water supplies. Primary treatment and chlorination at these places seems justified to prevent sludge deposits and to reduce bacterial loadings.

Augmentation of low flows in the Kanawha by operation of the proposed flood-control reservoirs would be a distinct help in correcting conditions in the lower Kanawha. Such help would reduce, but would not eliminate, the need for sewage treatment and industrial waste remedial measures. There are probably limits to the effectiveness of industrial waste remedial measures which will necessitate the discharge of large amounts of polluting material even after a maximum of practicable treatment and recovery. Even with a reduction comparable to that effected by a secondary sewage treatment plant, the industrial wastes in the Charleston area would have a population equivalent of more than 200,000. Since continued growth is to be expected, conditions will become worse. The national defense program is causing great increases in production at the chemical plants, both of war materials and of chemicals for synthetic fibers. The increased production will tend to aggravate stream conditions.

The Bluestone Reservoir, now being constructed by the U. S. Engineer Department, will increase the flow of the Kanawha by more than 600 c.f.s. or about 50 percent of the lowest summer monthly flow of record. Other reservoirs would supply less additional flow and their value for pollution control would be in proportion to the supplemental flow which they could provide. The Poca Reservoir, being downstream from Charleston, would have little value for pollution control. Augmentation of low flows by the Clendenin and Birch Reservoirs would ensure the adequacy of Charleston's Elk River water supply and obviate the necessity of using the more heavily polluted Kanawha River water during extremely dry years.

Increased low flow is practically always a benefit to organic pollution abatement. However, in the case of bacterial and taste and odor pollution, benefits are offset, in part, by the decreased time of flow which reduces the time natural purification agencies have to act.

Miscellaneous Pollution - At other communities along the Kanawha and New Rivers, primary treatment will be sufficient to maintain excellent stream conditions. Secondary treatment is indicated at such places as Richwood and Princeton, West Virginia, and Pulaski and Galax, Virginia, where stream flows often become very low. At Richwood pollution from a pulp mill has, until recently, caused serious pollution for some distance downstream in the Cherry River. The industry has now moved and with the treatment of Richwood's wastes the stream can be again made suitable for fish life.

Tastes and odors caused by wastes from the gas and petroleum industry in the Elk Basin give trouble at the Charleston water intake. Studies are being made to determine the best method of solving this problem.

Except for the Kanawha River in the Charleston area, and a few of the smaller tributaries, the streams of the Kanawha Basin can be maintained in good condition by the use of available waste treatment methods. The widespread use of the streams as sources of public water supplies and for recreational purposes justifies relatively high standards of water quality.

The estimated cost of the suggested pollution abatement program is summarized in Table K-1 together with estimates of the cost of existing sewage treatment plants and of programs for primary and for secondary treatment of all wastes.

TABLE K-7 KANAWHA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml.	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
					p.p.m.	% Sat.						
East Fork, Below Boone, N. C.	KNrEf 412	April 19	145	12.5	7.9	74.1	9.0	2,400	7.0	600	28	39
"	" "	" 23	69	6.5	10.4	84.5	3.6	9,300		11		35
"	" "	" 25	41	6.0	10.6	84.7	2.7	4,300		8	13	39
Boone Creek, below Boone, N. C.	KNrBo 412	April 19	87	12.5	8.3	77.5	6.5	240	7.1	650	32	51
"	" "	" 23	41	8.0	9.8	82.2	8.7	93				
"	" "	" 25	25	8.5	10.0	85.0	2.8	93			20	
Winkler Creek, below Boone, N. C.	KNrW 411	April 19	58	11.0	9.7	87.7	0.8	46	6.9			
"	" "	" 23	28	6.0	11.0	87.7	0.8	4				
"	" "	" 25	16	6.0	11.1	89.1	0.6	2			10	
Little Buffalo Cr. above W.Jefferson, W.Va.	KNrNfL 375	April 19	2	12.5	7.0	65.0	6.4	2,400	7.1		40	
"	" "	" 23	3	7.5	9.7	80.9	3.0	910				
"	" "	" 25	4	7.5	9.8	81.4	1.9	1,500			30	
Little Buffalo Cr. below W. Jefferson, W.Va.	KNrNfL 374	Apr. 19	2	12.5	6.7	62.7	9.8	1,100	7.1	525	41	63
"	" "	" 23	3	7.5	9.6	79.5	3.9	430		8		53
"	" "	" 25	4	7.5	9.8	81.6	2.0	2,400		10	31	50
Bledsoe Cr. above Sparta, N. C	KNrLrB 336	Apr. 19	6	12.0	9.4	86.3	0.5	24	6.9		13	
"	" "	" 23	8	6.0	10.8	86.2	0.5	2				
"	" "	" 25	10	6.0	10.8	86.7	0.5	9			12	
Bledsoe Creek, 200 ft. above mouth	KNrLrB 335	Apr. 19	6	12.5	9.4	88.0	1.3	460	7.1		18	
"	" "	" 23	8	6.5	10.9	88.3	0.7	460		5		29
"	" "	" 25	10	6.0	10.9	87.3	0.8	1,100		7	14	38
New River, above Fries, Va.	KNr 199	Apr. 22	3,130	8.0	10.3	86.4	0.9	24	6.9		15	
"	" "	" 24	2,720	8.5	10.2	86.9	0.6	15			15	
"	" "	" 26	2,300	9.5	9.9	86.6	0.8	15				
New River below Fries, Va.	KNr 197.5	Apr. 22	3,130	8.0	10.4	87.6	1.9	240	6.9		13	
" "	" "	" 24	2,720	8.5	10.0	85.2	1.0	460			14	
" "	" "	" 26	2,300	9.5	9.8	85.3	1.9	93				
Chestnut Cr. waterwks. intake, Galax, Va.	KNrC 306	Apr. 22	159	9.0	10.7	92.5	0.7	4	6.9		16	
" "	" "	" 24	107	7.5	10.5	87.1	0.7	24			18	
" "	" "	" 26	105	9.5	9.9	86.6	0.9	21				
Chestnut Cr. below milk plant, Galax, Va.	KNrC 305	Apr. 22	159	8.5	10.9	93.0	2.8	43	6.9		16	
" "	" "	" 24	107	7.5	10.5	87.1	1.0	240			16	
" "	" "	" 26	105	9.5	9.9	86.7	0.9	23				
Chestnut Cr. below all sewage, Galax, Va.	KNrC 304	Apr. 22	159	9.0	10.8	92.8	5.1	460	6.9	14	16	56
" "	" "	" 24	107	7.5	10.4	86.6	1.2	150		29	18	37
" "	" "	" 26	105	9.5	9.8	85.4	1.4	240		15		54

TABLE K-7 KANAWHA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
New River, above Austinville, Va.	KNr 286	Apr. 22	5,360	8.5	10.2	87.2	1.3	24	6.9		16	
" "	" "	" 24	3,410	9.5	10.2	89.2	0.8	46			16	
" "	" "	" 26	3,460	11.0	10.1	91.0	0.8	24				
New River, bridge on Rt.52, Austinville, Va.	KNr 282	Apr. 22	5,360	8.0	10.3	86.9	0.8	43	7.0	150	19	43
" "	" "	" 24	3,410	9.0	10.3	89.2	0.6	4		70	24	38
" "	" "	" 26	3,460	10.5	10.3	91.8	0.7	43		48		53
Crooked Cr. at mouth, Woodlawn, Va.	KNrCr 300.5	Apr. 24	87	7.5	10.8	89.9	0.7	9	6.9	35	15	29
" "	" "	" 26	86	9.0				12				
Reed Cr. above Wytheville, Va.	KNrRe 298	Apr. 11	126	10.0	10.1	88.8	2.2	4	7.8		71	
" "	" "	" 15	93	8.0	11.3	94.9	0.8	1			88	
" "	" "	" 16	88	12.0	10.3	94.9	0.8	24				
Reed Creek, below last sewer, Wytheville, Va.	KNrRe 297	Apr. 11	126	11.5	3.2	28.9	83.2	24,000	7.6		271	
"	" "	" 15	93	12.0	3.0	27.4	297	46,000			238	
"	" "	" 16	88	14.5	0.0	00.0	175	46,000				
Reed Creek - 2 miles below Wytheville, Va.	KNRRe 296	Apr. 11	126	10.5	10.3	92.2	1.2	1,100	8.2		77	
"	" "	" 15	93	10.5	11.5	102.2	1.2	4		12	98	148
"	" "	" 16	88	13.5	10.1	96.4	1.1	4		7		140
Peak Creek, above Pulaski, Va.	KNrP 268	Apr. 11	84	10.5	10.7	95.7	0.8	46	7.8			
"	" "	" 15	61	6.0	11.4	91.2	0.3	1		4	40	101
"	" "	" 16	58	10.5	10.2	90.9	0.7	2		4		103
Peak Creek - below last sewer, Pulaski, Va.	KNrP 266.5	Apr. 11	84	10.5	8.2	72.7	15.7 * 6.8	24	3.3			
"	" "	" 15	61	8.0	8.9	75.2	3.8* 1.6	8	2.9			
"	" "	" 16	58	12.5	7.2	66.9	3.8* 1.9	46	3.0			
Peak Creek - below Chem. Co. Pulaski, Va.	KNrP 267	Apr. 11	84	13.0	9.2	86.7	2.5* 0.8					
"	" "	" 15	61	8.5	9.1	77.2	1.1* 0.6	**	2.8			
"	" "	" 16	58	12.5	7.4	69.2	2.0* 0.6	**	3.0			
New River, above Radford, Virginia	KNr 248	Apr. 11	2,410	10.5	11.0	98.4	1.4	3	7.4	17	36	65
"	" "	" 15	3,030	7.0	10.2	84.2	0.8	1		10	42	88
"	" "	" 16	3,300	13.0	10.5	99.3	1.4	1		9		53
New River, below Radford, Va.	KNr 247	Apr. 11	2,720	12.5	11.2	104.9	1.1	9	8.1		44	
"	" "	" 15	3,270	7.0	10.4	85.2	0.5	4			41	
" "	" "	" 16	3,520	10.0	10.1	88.2	0.6	15				
Crab Creek, above Christiansburg, Va.	KNrCr 253.5	Apr. 10	4	17.0	13.6	139.6	6.1	240	8.7		229	
Crab Creek, at creamery Christiansburg, Va.	KNrCr 252.5	Apr. 12	3	11.5	3.6	33.3	5.3	230			238	
"	" "	" 17	2	13.5	0.3	3.2	10.7	11,000				

TABLE K-7 KANAWHA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth		Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
						p.p.m.	% Sat.						
Crab Cr. below treatmt. plant Christiansburg, Va	KNrCr	252	Apr. 10	4	16.0	9.0	90.5	4.2	4,600	8.1		238	
"	"	"	" 12	3	10.5	9.2	82.2	4.8	750		56	229	270
"	"	"	" 17	2	11.5	9.3	84.7	3.5	210		20		270
Stroubles Cr. above sewage plant, Blacksbg.	KNrSt	244	Apr. 10	5	11.5	9.5	27.0	3.2	9	8.0		193	
"	"	"	" 12	3	12.5	9.6	89.6	3.6	9			205	
"	"	"	" 17	2	14.5	11.1	107.8	3.4	4				
Stroubles Cr. below sewage plant, Blacksburg, Va	KNrSt	242	Apr. 10	5	12.0	9.0	82.9	3.1	930	7.9		201	
"	"	"	" 12	3	13.0	4.9	46.4	22.0	11,000			261	
"	"	"	" 17	2	14.5	8.2	79.9	9.7	2,300				
Stroubles Cr. 150 yds. abv. mouth, Blacksburg	KNrSt	235.5	Apr. 10	26	9.5	11.6	101.3	1.6	1,100	7.6		71	
"	"	"	" 12	17	11.5	10.4	95.1	1.6	23		9	98	136
"	"	"	" 17	13	13.5	11.4	108.5	2.0	4		4		193
New River, 4.2 miles above Pearisburg, Va.	KNr	206	Apr. 10	2,320	9.0	10.9	94.0	0.9	46	7.4		49	
New River - 2 miles above Pearisburg, Va.	KNr	204	Apr. 12	3,570	9.5	9.8	85.6	1.2	4			47	
"	"	"	" 17	2,950	14.0	9.8	94.4	0.8	9				
New River, below Narrows, Va.	KNr	199	Apr. 10	3,170	8.0	10.8	90.8	1.1	15	7.4	40	47	71
"	"	"	" 12	3,700	10.0	9.7	85.3	1.2	9		18	51	97
"	"	"	" 17	3,900	15.5	9.4	93.1	0.9	4		17		99
New River, Sanitary waste, Narrows, Va.	KNr	197	Apr. 10		6.0	8.3	66.4	25.3	24,000	7.5		67	
New River, Process wastes, Celanese Corp. Narrows, Va.	KNr	197	Apr. 10		27.5	6.4	80.1	35.4	4	7.9		65	
"	"	"	" 12		17.5	8.9	91.9	41.3	**			64	
"	"	"	" 17		16.5	9.1	92.8	36.2	1	7.9			
Rich Creek - below Peterstown, Va.	KNrRi	195	Apr. 29	30	11.5	10.4	94.9	0.9	9	7.9	13	105	109
"	"	"	May 2	24	10.0	10.3	90.6	1.5	150		56	74	74
"	"	"	" 7	16	15.5	9.8	97.4	0.7	23		11		106
Grassy Branch-below RR yds. drain, Bluefield, W.Va.	KNrErG	209	Apr. 29	1	22.5	6.9	78.7	20.5	360	7.9	230	112	162
"	"	"	May 2	1	13.5	8.3	78.8	7.9	9		125	154	113
"	"	"	" 7	1	21.5	5.0	67.5	45.5	230		97		136
East River, at mouth Glenlyn, Va.	KNrEr	189	Apr. 29	81	11.[illegible]	[illegible]	[illegible].6	0.7	23	7.9	7	113	118
"	"	"	May 2	62	9.0	10.[illegible]	87.4	0.9	240		21	116	109
"	"	"	" 7	41	15.5	9.0	89.7	0.5	9		6		115
New River, bridge below Glenlyn, Va.	KNr	189	Apr. 29	3,450	12.0	10.0	92.6	0.5	15	7.5	14	53	69
"	"	"	May 2	5,220	11.0	9.7	87.4	0.7	9		24	52	52
"	"	"	" 7	4,180	15.5	9.1	90.1	0.6	7		13		63

TABLE K-7 KANAWHA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Bluestone R. Water plt. intake, Bluefield, W.Va	KNrB1 218	May 1	36	13.0	9.9	93.4	0.5	15	7.8		102	
"	" "	" 6	26	14.0	10.7	103.4	0.9	93			109	
"	" "	" 9	27	14.5	8.3	81.3	0.7	9				
Bluestone River, above Beaver Pond Cr., Bluef.	KNrB1 216.5	May 1	26	12.5	10.1	94.1	0.9	43	7.9		107	
"	" "	May 6	20	12.0	10.7	99.1	1.4	240			108	
"	" "	" 9	20	15.5	8.4	83.4	1.2	43				
Beaver Pond Cr. at mou. Bluefield, W. Va.	KNrB1B 216.5	May 1	9	12.0	8.3	76.7	4.0	2,400	7.8	15	134	133
"	" "	" 6	6	11.5	8.6	78.7	8.0	930		10	151	143
"	" "	" 9	6	12.5	8.0	74.3	2.8	930		10		137
Bluestone R. 1 mi. bel. sew.plant, Bluefield	KNrB1 215	May 1	36	12.5	9.0	84.4	2.6	23	7.6	14	113	109
"	" "	" 6	26	13.0	10.2	96.2	2.7	4		9	122	119
"	" "	" 9	27	15.0	7.7	76.0	3.6	7		9		120
Bluestone R. below Nemours, W. Va.	KNrB1 211	Apr. 30	74	17.0	8.6	88.4	2.1	23	7.6		83	
"	" "	May 3	59	7.0	9.3	76.3	2.4	23			88	
"	" "	May 8	37	22.5	7.9	90.3	2.3	23				
Laurel Creek, above Pocahontas, W. Va.	KNrB1L 211	Apr. 30	8	14.0	9.9	95.1	1.0	110	7.3		23	
"	" "	May 3	6	7.5	11.0	91.1	1.2	460			28	
"	" "	" 8	4	20.0	9.2	100.0	2.0	23				
Laurel Creek - below Pocahontas, W. Va.	KNrB1L 209.5	Apr. 30	8	16.0	7.5	75.5	6.3	4,600	6.8	70	26	120
"	" "	May 3	6	8.5	8.4	72.0	10.6	2,400		48	28	127
"	" "	" 8	4	21.0	5.7	63.8	10.0	11,000		22		141
Bluestone River, above Bramwell, W. Va.	KNrB. 208	Apr. 30	82	17.0	8.6	87.9	1.5	43	7.7		77	
"	" "	May 3	66	11.0	9.3	83.6	1.1	43			80	
"	" "	" 8	41	22.0	8.4	94.9	1.7	43				
Bluestone River, below Simmons, W. Va.	KNrB1 207	Apr. 30	87	15.0	8.4	82.4	0.9	240	7.4		69	
" "	" "	May 3	70	8.5	9.3	79.0	0.9	460			72	
" "	" "	" 8	46	19.5	7.6	81.6	1.3	91				
Crane Creek, at mouth Montcalm, W. Va.	KNrB1C 203	Apr. 30	20	13.5	9.6	91.4	0.6	93	7.9	32	131	161
" "	" "	May 3	16	7.5	10.0	83.0	1.0	75		36	145	168
" "	" "	" 6	11	17.0	8.8	90.6	0.6	93		28		171
Wide Mouth Creek, above Matoka, W. Va.	KNrB1W 205.5	May 1	21	10.5	9.4	83.7	1.3	110	7.6		89	
" "	" "	" 6	14	8.0	10.0	84.2	0.6	39			99	
" "	" "	" 9	13	13.5	9.0	85.5	0.8	460				
Wide Mouth Creek, below Matoka, W. Va.	KNrB1W 204	May 1	21	11.0	9.2	82.6	1.3	210	7.5		89	
" "	" "	" 6	14	8.5	9.8	83.9	1.2	230			102	
" "	" "	" 9	13	14.0	8.3	80.2	8.0	2,400				

TABLE K-7 KANAWHA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c. f. s.	Temp. °C	Dissolved Oxygen p. p. m.	Dissolved Oxygen % Sat.	5 Day B. O. D. p. p. m.	Coliforms M. P. N. Per ml.	pH	Turbidity p. p. m.	Alkalinity p. p. m.	Hardness p. p. m.
Wide Mouth Creek, at mouth	KNrBlW 201.5	May 1	32	11.5	9.7	88.2	1.0	43	7.6	12	78	146
" "	" "	" 6	20	10.0	10.2	89.9	2.0	23		7	90	165
" "	" "	" 9	20	16.5	9.0	91.6	0.9	93		12		175
Bluestone River, Kegley, W. Va.	KNrBl 193	Apr. 30	208	14.0	9.2	88.5	0.6	21	7.6		71	
" "	" "	May 3	167	8.0	9.9	83.2	1.0	240		[illegible]	80	120
" "	" "	" 8	102	18.5	8.3	88.3	0.7	23				
Brush Creek, above Princeton, W. Va.	KNrBlBr191.5	Apr. 29	26	15.0	10.0	98.2	0.5	150	7.0		27	
" "	" "	May 2	22	10.0	9.2	81.4	0.7	21			37	
" "	" "	" 7	13	17.5	9.1	94.3	0.5	93				
Brush Creek, below Princeton, W. Va.	KNrBlBr 189	Apr. 29	26	14.0	8.2	78.6	2.3	360	7.0		32	
" "	" "	May 2	22	9.5	5.6	57.6	1.0	150		19	46	48
" "	" "	" 7	13	17.5	1.8	18.4	4.0	2,400				
Laurel Creek, below Athens, W. Va.	KNrBlLa 155	Apr. 29	8	11.0	10.7	96.6	2.4	1,100	7.3	11	38	54
" "	" "	May 2	6	9.5	10.4	91.2	3.8	430		12	49	56
" "	" "	" 7	3	15.0	8.0	78.3	6.5	11,000		22		62
Brush Creek - at mouth Speedway, W. Va.	KNrBlBr 182	Apr. 29	42	13.0	10.3	97.5	0.6	9	7.3	17	30	51
" "	" "	May 7	[illegible]	15.5	9.6	96.0	1.4	3		8	48	47
Bluestone River, at mouth	KNrBlBr 182	Apr. 30	370	14.0	9.5	92.0	0.5	23	7.5	14	45	56
" "	" "	May 3	303	9.0	10.1	86.8	0.8	15		52		
" "	" "	" 8	178	19.0	8.6	91.8	0.9	4		8		87
E.Fk.Greenbrier River above Durbin, W. Va.	KNrGrEf 300	May 27	772	13.0	10.0	94.3	0.8	4	6.9		18	
" "	" "	" 31	990	12.5	10.0	93.2	0.8	24	6.8		17	
" "	" "	June 5	319	17.0	9.8	100.5	0.4	12	6.9			
E. Fk. Greenbrier R. below Durbin, W. Va.	KNrGrEf 297	May 27	772	12.5	9.5	88.8	2.7 2.2*	4	8.7		22	
" "	" "	" 31	990	13.5	9.9	94.7	1.3	9	7.0	27	20	18
" "	" "	June 5	319	16.5	9.4	95.3	1.6	4	7.2	4		23
Greenbrier River, below Durbin, W. Va.	KNrGr 295	May 27	1,390	13.5	9.5	90.3	1.5	4	7.2	12	19	23
" "	" "	" 31	2,800	13.5	9.8	93.5	1.1	24	6.9		19	
" "	" "	June 5	415	17.5	9.2	95.9	1.1	9	7.0			
Greenbrier River below Cass, W. Va.	KNrGr 291	May 27	1,390	14.0	9.4	90.2	0.6	9	7.1		22	
" "	" "	" 31	2,800	12.5	9.7	90.8	0.8	9	6.9		20	
" "	" "	June 5	415	17.0	9.4	96.3	0.5	9	7.0			
Greenbrier River, Above Marlington, W.Va.	KNrGr 267.5	May 27	3,470	14.5	9.0	87.8	0.7	4	7.2		29	
" "	" "	" 31	6,010	13.0	9.7	91.2	0.4	15	7.0		21	
" "	" "	June 5	1,930	19.0	8.3	88.8	0.5	9	7.1			

TABLE K-7 KANAWHA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C.	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml.	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Greenbrier River, below Marlington, W. Va.	KNrGr 264	May 27	3,470	16.0	9.4	94.5	0.9	43	7.1		24	
" "	" "	" 31	6,010	13.0	9.6	90.7	0.7	93	7.1		28	
" "	" "	June 5	1,930	19.0	8.3	89.2	0.6	240	7.3			
Howard Creek, below White Sulphur Springs	KNrGrH 213.5	May 29	81	13.5	9.5	91.0	0.3	4	7.2		43	
" "	" "	June 4	52	15.5	9.0	89.8	0.4.	2	7.2	42		
" "	" " "	" 6	58	18.0	8.5	88.8	0.1	4				
Howard Creek at mouth Caldwell, W. Va.	KNrGrH 208.5	May 29	121	12.5	9.5	88.9	0.3	23	7.2	3	43	45
" "	" "	June 4	77	16.0	9.1	91.8	0.4	23	7.2	4	38	49
" "	" "	" 6	88	18.0	8.5	89.4	1.0	43		4		
Greenbrier River, water works intake, Lewisburg	KNrGr 208.5	May 27	2,320	17.5	9.2	95.1	1.0	24	7.1	18	28	28
" "	" "	" 31	10,400	13.5	9.5	90.6	0.7	110	7.0	170	37	31
" "	" "	June 5	994	23.5	9.0	104.3	0.7	4	7.3	22		38
Greenbrier River, Ronceverte, W. Va.	KNrGr 203	May 28	2,580	17.0	9.2	94.4	0.9	43	7.1		30	
" "	" "	June 3	1,910	19.0	9.3	99.6	0.6	4	7.3		33	
" "	" "	" 6	1,200	23.0	9.0	103.3	0.4	9	7.3			
Fort Spring Creek, Fort Spring, W. Va.	KNrGrF 194	May 28	163	12.5	9.0	84.3	0.8	93	7.4	52	116	104
" "	" "	June 3	121	14.5	9.3	90.6	1.7	43	7.5	27	118	109
" "	" "	" 6	76	15.0	8.8	86.7	0.7	23	7.4	18		123
Greenbrier River, water works intake, Alderson	KNrGr 188	May 28	2,580	16.0	8.9	89.6	0.9	9	7.2		33	
" "	" "	June 3	1,910	18.0	9.1	95.6	0.6	9	7.3		37	
" "	" "	" 6	1,200	21.0	8.0	89.2	0.4	46				
Greenbrier River, below Alderson, W. Va.	KNrGr 187	May 28	2,580	15.0	9.9	97.9	0.6	15	7.2		31	
" "	" "	June 3	1,910	16.5	9.0	91.2	0.4	9	7.3		49	
" "	" "	" 6	1,200	21.0	8.1	90.3	0.3	23				
Greenbrier River Hinton, W. Va.	KNrGr 161.5	May 28	6,900	15.5	9.0	90.0	0.6	23	7.2	25	37	36
" "	" "	June 3	5,300	16.0	9.2	92.0	0.4	240	7.3	16	42	38
" "	" "	" 6	2,900	21.5	8.3	92.9	0.4	75		15		46
New River, Hinton, W. Va.	KNr 159	May 28	12,600	16.0	8.9	89.8	0.9	9	7.3	45	40	46
" "	" "	June 3	15,200	18.5	8.8	93.2	0.8	4	7.4	29	55	46
" "	" "	" 6	12,200	22.0	8.1	91.7	0.7	110		30		57
Glade Creek, above Beckley, W. Va.	KNrGl 152.5	May 15	6	12.5	9.1	84.6	0.7	4	6.8	6	13	18
" "	" "	" 20	4	16.5	8.4	85.4	0.9	24	6.7	12	15	17
" "	" "	" 23	4	16.0	8.6	86.5	0.5		6.7	4		
Big Beaver Creek, at mouth Beckley, W.Va.	KNrPiB 143	May 15	13	16.5	9.0	90.9	1.8 2.6•	46	3.9	3		78
" "	" "	" 20	10	16.0	8.8	87.9	2.1 1.2•	460	4.2	45	11	64
" "	" "	" 23	9	16.0	8.6	86.6	0.9 0.5•	23	3.7	10		59

TABLE K-7 KANAWHA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C.	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Piney River, above treatment plt, Beckley	KNrPi 143.5	May 15	23	17.0	8.9	91.2	0.8 1.0*	4	5.3		11	
" "	" "	" 20	16	17.0	8.2	84.6	1.1 1.0*	46	4.5		10	
" "	" "	" 23	15	17.0	8.8	89.8	0.3 0.3*	9	4.8			
Piney River, below treatment plant, Beckley	KNrPi 143	May 15	23	16.0	8.6	86.7	2.5 3.2*	210	5.5		10	
" "	" "	" 20	16	17.0	8.2	84.7	2.2 1.8*	930	4.9		13	
" "	" "	" 23	16	16.0	8.6	86.5	0.9 1.0*	36	4.8			
L. Whitestick Cr. above treatment plt Beckley	KNrPiL 141	May 13	3	14.0	9.6	92.1	1.5	1,100	8.1		135	
" "	" "	" 16	3	12.0	9.6	88.2	0.9	43	7.5		69	
" "	" "	" 21	3	13.0	9.3	87.5	0.8	43	7.4		62	
L. Whitestick Cr. Below treatment plant, Beckley, W. Va.	KNrPiL 139	May 13	3	15.0	4.8	47.1	72.7	24,000	7.6	90	179	126
" "	" "	" 16	3	12.5	7.5	70.4	6.8	4,300	7.5	9	76	160
" "	" "	" 21	3	13.5	8.1	77.7	3.9	360	7.3	4	59	86
Mountain Stream, Mabscott, W. Va.	KNrPiM 147	May 15		16.0	7.7	77.6	1.1	23	6.7	14	36	209
" "	" "	" 18		14.5	8.5	82.9	0.4 0.8*	4	5.1	12	17	189
Piney River, above Raleigh, W. Va.	KNrPi 142	May 13	27	17.5	8.6	89.4	0.7	4	6.5	8	15	72
" "	" "	" 16	22	14.5	8.7	84.4	0.4	2	6.8	7	15	77
" "	" "	" 21	19	15.5	8.7	86.8	0.6	24	6.6	27	12	44
Whitestick Creek at mouth	KNrPiW 143.5	May 15	6	18.5	8.8	93.2	1.6	460	7.3	4	32	262
" "	" "	" 20	5	15.0	8.1	79.7	6.0	2,400	7.1	135	38	110
" "	" "	" 23	4	15.5	8.3	82.6	4.6	430	7.3	12		109
Beaver Creek - above Blue Jay, W. Va.	KNrPiB 147	May 15	11	14.5	8.1	79.2	0.5 0.5*	**	3.9			
" "	" "	" 20	9	14.5	8.1	78.6	0.8 0.5*	2	3.6			
" "	" "	" 23	8	15.5	7.9	79.0	0.2 0.2*	**	4.2			
Piney River at mouth McCreery, W. Va.	KNrPi 134	May 15	59	17.5	9.0	93.8	0.9	4	7.0	2	19	114
" "	" "	" 20	47	20.5	8.1	81.8	3.9	110	6.8	175	22	83
" "	" "	" 23	42	16.5	8.9	90.2	0.4	9	6.7	3		73
Dunloup Creek, above Mount Hope, W. Va.	KNrD 132	May 15	7	12.0	9.7	89.2	0.6	1	3.7			
" "	" "	" 17	6	11.5	9.8	89.3	0.6 0.5*	1	3.5			
" "	" "	" 22	5	13.0	9.2	86.5	0.2 0.3*	4	3.7			
Dunloup Creek, below Mount Hope, W. Va.	KNrD 130.5	May 14	7	16.0	8.2	82.7	6.7 6.4*	1	3.7			
" "	" "	" 17	6	12.5	8.3	77.4	2.6 1.3*	3	3.6			
" "	" "	" 22	5	15.0	8.6	85.0	1.5 0.9*	46	3.9			
Dunloup Creek, below Scarbro, W. Va.	KNrD 127	May 14	14	17.5	8.7	90.1	1.4	1,100	8.3		252	
" "	" "	" 17	1	13.5	9.5	90.5	1.3	1,500	8.2		260	
" "	" "	" 22	1	15.0	8.8	87.1	0.6	230	7.5			

TABLE K-7 KANWAHA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c. f. s.	Temp. °C	Dissolved Oxygen p. p. m.	Dissolved Oxygen % Sat.	5 Day B. O. D. p. p. m.	Coliforms M. P. N. Per ml	pH	Turbidity p. p. m.	Alkalinity p. p. m.	Hardness p. p. m.
Dunloup Creek, below Hervey, W. Va.	KNrD 125.5	May 14	20	16.0	9.0	90.0	0.9	93	7.5		110	
" "	" "	" 17	16	14.0	9.5	91.7	1.4	460	7.5		91	
" "	" "	" 22	14	16.5	9.1	92.8	0.3	36	7.0			
Dunloup Creek at mouth Thurmond, W. Va.	KNrD 122.5	May 14	26	16.0	9.2	92.6	0.6	39	7.3	23	44	234
" "	" "	" 17	22	14.0	9.8	94.3	0.9	43	7.1	18	29	236
" "	" "	" 22	13	15.5	9.3	92.7	0.4	23	6.8	17		117
Arbuckle Creek - below Minden, W. Va.	KNrAr 123	May 14	7	16.0	8.9	69.7	4.0	1,100	8.1	15	213	123
" "	" "	" 17	6	14.5	9.2	90.2	3.5	2,400	8.1	8	211	124
" "	" "	" 22	5	17.5	8.1	83.6	1.9	430	1.9	13		84
Wolf Creek above Fayetteville, W. Va.	KNrWo 110	May 14	6	13.5	9.1	87.2	0.8	4	7.5		57	
" "	" "	" 17	4	15.0	9.9	97.7	0.8	4	7.5		70	
" "	" "	" 22	4	15.5	9.0	89.6	0.3	9	6.7			
Br. Laurel Cr. Below Fayetteville, W. Va.	KNrWo 109.5	May 14		12.5	9.4	87.9	0.6	4	6.9	4	21	26
" "	" "	" 17		13.0	9.8	92.7	0.6	1	6.5	5	21	24
" "	" "	" 22		14.5	9.0	87.8	0.5	9	6.6	11		25
Wolfe Creek - below Fayetteville, W. Va.	KNrWo 109	May 14	6	12.5	10.1	94.2	0.6	4	8.4	3	229	62
" "	" "	" 17	4	13.0	10.3	97.1	0.7	2	8.5	3	240	49
" "	" "	" 22	4	16.0	9.4	94.8	0.8	23	7.3	8		29
New River at mouth	KNr	Dec.5'39	1,580	5.5	12.0	94.5	0.5	4	7.4	8	65	97
" "	" "	" 7'39	1,910	5.5	12.3	97.0	1.2	1	7.5	6	65	
Gauley River, above mouth of Cherry River	KGa 157.5	Jan. 15	1,170	0.0	13.3	91.0	1.4	46	6.0	15	6	55
" "	" "	Feb. 9	1,020	0.0	13.4	91.5	0.6	4	6.1	7	6	47
Cherry River, at water intake abv.Richwood	KGaC 167	Jan. 15	435	0.0	13.4	91.3	3.1	1	5.9	15	5	
" "	" "	Feb. 9	225	0.0	13.4	91.3	0.5	1	6.1	6	5	43
Cherry River - below Richwood, W. Va.	KGaC 166	Jan. 15	435	0.0	13.1	89.8	1.8	43	5.9	8	6	
" "	" "	Feb. 9	225	0.0	13.0	89.0	0.6	4	6.3	17	8	51
Cherry River - below Fenwich, W. Va.	KGaC 164	May 29	605	13.5	10.0	95.0	0.4	4	6.8	6	14	19
" "	" "	June 4	593	17.5	9.2	95.9	0.3	2	6.8	35	21	26
" "	" "	" 7	294	20.0	8.9	96.8	0.3	9		12		19
Gauley River ½ mile below mouth Cherry R.	KGa 157	Jan. 15	1,680	0.0	13.2	90.2	1.2	93	6.0	13	6	49
" "	" "	Feb. 9	1,480	0.0	13.4	91.5	0.4	9	6.2	5	6	49
Arbuckle Creek - below Summerville, W. Va.	KGaA 143.5	May 29	1	14.5	9.0	88.1	0.6	240	6.7	10	21	47
" "	" "	June 4	1	17.0	8.5	87.7	0.1	93	6.7	20	25	22
" "	" "	" 7	**	21.5	7.6	84.8	0.7	460		14		22

TABLE K-7 KANAWHA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c. f. s.	Temp. °C.	Dissolved Oxygen p. p. m.	Dissolved Oxygen % Sat.	5 Day B. O. D. p. p. m.	Coliforms M. P. N. Per ml.	pH	Turbidity p. p. m.	Alkalinity p. p. m.	Hardness p. p. m.
Sewell Creek - above Rainelle, W. Va.	KGaMS 157	May 29	56	15.5	9.7	96.8	0.6	4	6.7		17	
" "	" "	June 4	43	17.0	9.1	93.6	0.2	9	6.8		25	
" "	" "	" 7	28	21.5	8.5	95.5	0.2	15				
Sewell Creek - below E. Rainelle, W.Va.	KGaMS 155.5	May 29	116	15.0	9.0	89.0	1.0	460	6.7	24	21	18
" "	" "	June 4	89	18.0	8.3	87.2	0.4	2,400	6.7	17	23	19
" "	" "	" 7	57	22.0	7.4	84.4	0.6	430		13		
Gauley River at mouth	KGa	Dec. 5	62	4.5	12.1	93.1	2.6	1,100	6.7	8	15	79
" "	" "	" 7	198	4.5	12.2	94.0	2.3	93	6.8	5	14	
Kanawha River, water intake Glen Ferris, W.Va.	K 95.6	Feb. 14	16700	3.5	12.5	93.7	0.4	15	6.2	15	10	
" "	" "	" 20	18300	4.0	12.6	96.1	2.5	9	6.7	11	14	
Kanawha River 2 miles below Gauley Bridge	K	Dec.5'39	1,640	4.0	12.1	91.8	0.6	9	7.3	11	63	116
" "	"	" 7	2,110	4.0	12.0	91.5	0.8	4	7.5	6	65	
Mountain Stream, Charleston Height, WVa.	K 93	Feb. 14		4.0	11.8	90.3	1.5	**	6.9	3	23	
" "	" "	" 20		6.0	11.5	92.0	0.7	**	6.7	5	20	
Kanawha River -water intake, Alloy, W.Va.	K 89.7	Feb. 14	16,700	3.5	12.6	94.9	0.6	46	6.9	37	19	
" "	" "	" 20	18,300	6.0	12.8	102.6	1.0	43	6.7	15	16	
Kanawha River, lower edge Harewood, W.Va.	K 88	Mar. 12	5,930	3.0	13.1	97.3	0.6	23	7.1	6	27	
Kanawha River waterwks intake, Montgomery W Va	K 85.6	Feb. 14	16,700	2.0	13.1	94.9	1.3	110	7.1	77	31	
" "	" "	" 20	18,300	4.0	13.2	100.5	0.8	23	6.9	18	30	
Kanawha River U.S.Lock at London, W. Va.	K 82.8	Dec.5'39	1,660	5.5	11.8	95.8	0.8	150	7.3	9	63	113
" "	" "	" 7	2,140	6.0	11.7	93.8	1.0	23	7.5	7	66	
" "	" "	" 14	2,220	5.5	12.1	95.5	2.6	14	7.3	20	60	
" "	" "	Jan.4'40	1,340	0.0	13.7	93.6	0.8	46	7.2	5	52	
" "	" "	" 10	1,840	2.0	14.1	102.0	0.8	9	7.2	5	54	
" "	" "	" 18	4,850	2.0	14.0	101.1	1.1	21	7.2	8	39	
Kanawha River water intake Cedar Grove, W.Va	K 77.5	Mar. 12	6,650	4.0	13.2	100.7	0.6	23	7.1	12	29	
Cabin Creek - at mouth Chelyan, W. Va.	K 74.4	Mar. 12	36	4.0	12.2	93.1	1.2	240	7.1	4	24	
Kanawha River water intake, Chelyan, W.Va.	K 73.7	Feb. 14	16900	1.0	13.2	92.8	2.0	15	7.1	120	33	
" "	" "	" 20	18500	4.5	12.7	98.1	1.5	46	6.9	19	25	

TABLE K-7 KANAWHA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth		Date	Average Discharge c.f.s.	Temp °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Kanawha River, U.S. Lock, Belle, W.Va.	K	67.7	Dec.5'39	1,760	3.0	9.6	82.7	3.5	43	7.5	13	78	100
" "	"	"	" 7	2,090	8.5	10.2	87.2	3.2	150	7.4	12	69	
" "	"	"	" 14	2,180	7.5	10.7	89.1	5.6	23	8.2	11	80	
" "	"	"	Jan.4'40	1,180	2.5	12.6	91.9	3.4	8	7.2	8	51	
" "	"	"	" 10	1,650	2.0	12.1	87.1	3.3	4	7.3	14	57	
" "	"	"	" 18	4,930	2.0	12.9	93.1	2.0	24	7.4	6	48	
" "	"	"	" 31	2,290	2.0	13.0	93.9	1.5	24	7.3	18	50	
Kanawha River, Kanawha city Bridge, Charlestn.	K		Feb.24'41	5,740	0.0	12.6	86.4	4.0	15	7.6			
" "	"		" 28	6,300	1.5			2.3	43	7.6			
Kanawha R. C&O Bridge Charleston, W. Va	K		2-24-41	5,740	0.5	13.0	90.2	2.6	4	7.6			
" "	"	"	Feb. 28	6,300	2.0	13.0	87.1	4.1	73	7.4			
Kanawha R. Patrick St. Bridge, Charleston, WVa.	K	56.3	Dec.8'39	2,250	7.0	8.6	73.3	[illegible]	1,100	7.4	17	73	
" "	"	"	" 14	2,970	4.5	10.1	77.9	3.2	240	7.2	16	53	
" "	"	"	Jan.4'40	1,370	0.5	11.8	81.8	3.1	313	7.1	17	45	
" "	"	"	Jan.10	1,800	1.5	11.6	82.8	5.4	1,100	7.0	22	52	
" "	"	"	Jan 18	6,060	0.5	13.1	90.6	1.2	70	7.3	16	48	
" "	"	"	" 31	2,520	1.5	12.3	87.5	2.2	930	7.4	22	53	
" "	"	"	Feb. 2	2,230	2.0	11.6	83.9	5.1	73	7.1	28	53	
" "	"	"	Feb.24'41	5,740	0.0	12.9	88.1	2.4	240	7.4			
" "	"	"	" 28	6,300	0.0	13.2	90.3	0.8	210	7.0			
Kanawha R. below Capitol Bldg. Charleston	K		Mar. 12	7,850	4.0	12.4	94.7	4.3	91	7.2	15	33	
Kanawha R. above Bratfore St. Charleston	K		Mar. 12	7,850	4.0	11.9	90.0	16.9	11,000	7.2	22	37	
Kanawha R. Foot of Capitol St., Charleston	K		Mar. 12	7,850	6.0	10.6	84.8	43.7	24,000	7.4	70	53	
Kanawha R. below Truslow St, Charleston, W.Va.	K		Mar. 12	7,850	4.0	11.7	88.8	44.7	24,000	7.3	45	44	
Elk River waterworks intake, Webster Springs	KE1	198	Jan. 15	524	0.0	13.4	91.5	2.3	110	6.6	64	25	22
Elk River ½ mi. above waterworks Webster Spgs	KE1	198.5	Feb. 9	654	2.0	13.1	94.8	1.0	9	6.7	59	7	23
Elk R. RR Bridge 100 yds. below forks, Webster Springs, W. Va.	KE1	196.5	Feb. 9	654	2.5	13.4	97.9	0.6	23	6.4	42	10	14
Elk River 1/2 mile below Webster Springs	KE1	197	Jan. 15	524	0.0	13.3	91.2	1.0	43	6.1	53	17	11
Elk River -waterworks intake, Sutton, W.Va.	KE1	159	Jan. 15	1,150	0.5	13.5	93.5	0.4	2	6.3	57	5	11
" "	"	"	Feb. 9	1,300	2.0	13.4	96.8	0.4	4	6.3	45	15	12
Elk River 1/2 mile below Suttor, W. Va.	KE1	157.5	Jan. 15	1,150	0.5	13.6	94.3	1.6	43	6.3	56	9	12
" "	"	"	Feb. 9	1,300	2.5	13.3	97.7	0.5	43	6.4	52	12	12

TABLE K-7 KANAWHA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth		Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
						p.p.m.	% Sat						
Elk River 3/4 mile below Gassaway, W.Va.	KE1	152	Jan. 15	1,150	3.0	13.4	99.6	0.4	75	6.3	68	8	13
" "	"	"	Feb. 9	1,300	5.0	13.1	102.0	0.4	43	6.4	49	25	12
Elk River - above Clendenin, W. Va.	KE1		Dec.4'39	86	6.0	11.4	91.6	2.5	24	6.9	54	13	24
" "	"		" 6	138	5.5	11.6	91.6	0.7	9	6.9	8	21	
Elk River - below Clendenin, W. Va.	KE1		Dec. 4	86	5.0	10.6	83.0	3.3	1,100	6.9	20	27	72
" "	"		Dec. 6	138	6.0	10.9	87.6	1.7	21	6.9	11	26	
Elk R. 1 mi. below Refining Co.Falling Rock	KE1		Dec. 4	100	6.0	10.7	85.5	2.1	110	6.9	8	25	70
" "	"		Dec. 6	161	6.0	10.8	86.9	1.4	23	6.9	9	26	
Elk River - Bridge at Big Chimney, W. Va.	KE1	79.5	Dec. 14	1,080	3.5	11.8	88.7	1.6	43	6.9	10	26	
" "	"	"	Jan.4'40	250	0.0	13.9	95.3	0.8	9	6.8	7	16	
" "	"	"	" 10	200	0.0	13.4	91.9	0.7	8	6.7	7	16	
" "	"	"	Jan. 18	1,530	0.0	13.5	92.6	0.5	9	6.7	15	14	
" "	"	"	2-24-41		4.0	13.4	102.4	1.4	24	7.0			
" "	"	"	Feb. 28		0.0	13.4	91.9	1.2	4	6.9			
Elk River - water intake 4 mi.abv.Chaston.	KE1	75	12-4-39	116	5.0	10.9	85.3	1.7	24	7.0	81	7	33
" "	"	"	Dec. 6	186	5.5	10.5	82.3	2.4	9	6.9	10	34	
Elk River - filter plant,Charleston,W.Va.	KE1	71	Dec.4'39	116	5.0	10.1	79.0	1.7	1,100	7.0	8	30	79
" "	"	"	" 5	153	6.0	10.2	81.5	1.8	460	6.9	7	32	62
Elk River - Coon Skin intake,Charleston,WVa.	KE1	71	Mar. 12	1,590	3.5	12.7	95.4	1.3	4	6.3	3	12	
Elk River - Virginia St.Bridge,Charleston	KE1	60	Jan. 4	250	1.0	13.8	97.0	1.3	110	6.7	9	16	
" "	"	"	" 10	200	0.0	13.5	92.5	1.0	93	6.7	12	17	
" "	"	"	" 18	1,530	0.0	13.7	93.4	0.5	23	6.8	17	16	
" "	"	"	2-24-41		0.5	13.9	96.7	1.5	43	6.9			
" "	"	"	Feb. 28		0.0	13.4	91.4	1.6	460	6.8			
Elk River-Washington St.Bridge,Charleston	KE1	58	Mar. 12	1,590	3.0	12.6	93.8	0.5	43	6.9	8	13	
Two Mile Creek - at mouth Charleston,W.Va.	KTw	55	Mar. 4	340	6.5	11.2	90.5	2.2	430	6.9	110	21	
" "	"	"	" 12	8	2.0	11.4	82.4	6.6	15	7.1	11	46	
Kanawha R. Toll Br. St. Albans, W. Va.	K	45.6	Dec.6'39	1,820	9.0	4.6	39.8	4.8	430	7.3	11	73	204
" "	"	"	" 8	2,250	8.0	3.8	32.4	2.9	210	7.4	12	72	
" "	"	"	" 14	2,970	6.0	5.3	42.1	3.9	132	7.2	18	69	
" "	"	"	1-4-40	1,370	3.0	10.6	79.0	5.8	93	7.0	21	39	
" "	"	"	Jan. 10	1,800	1.0	10.5	73.9	7.6	60	6.7	27	61	
" "	"	"	" 18	6,060	[illegible]	12.2	85.5	3.7	240	7.4	12	52	
" "	"	"	" 29	1,800	0.0	11.3	77.6	7.5	93	7.3	17	45	

TABLE K-7 KANAWHA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth		Date 1940	Average Discharge c. f. s.	Temp. °C	Dissolved Oxygen		5 Day B. O. D. p. p. m.	Coliforms M. P. N. Per ml.	pH	Turbidity p. p. m.	Alkalinity p. p. m.	Hardness p. p. m.
						p. p. m.	% Sat.						
Kanawha River - Toll Bridge, St. Albans, W. Va.	K	45.6	Jan. 31	2,520	2.0	11.7	84.5	4.9	240	7.3	21	47	
" "	"	"	Feb. 13	2,770	3.5	13.2	98.9	1.3	23	7.1	120	28	68
" "	"	"	" 28	12700	4.5	12.4	95.5	2.4	150	7.4	18	33	
" "	"	"	Mar. 14	8,050	4.5	11.9	91.8	2.6	93	7.3	18	31	84
" "	"	"	Feb.28'41		1.0	12.2	85.8	5.6	75	8.1			
Big Coal R. water intake above Whiteville	KB1	97	May 13	10	13.0	10.1	95.2	0.5	23	7.3		36	
" "	"	"	" 16	8	16.0	10.0	100.1	0.5	21	7.3		37	
" "	"	"	" 21	10	15.0	9.3	91.2	1.1	43	6.9		16	
Big Coal River 1 mile below Whiteville, W. Va.	KB1	96	May 13	10	14.0	10.1	97.1	0.6	23	7.3	6	34	78
" "	"	"	" 16	8	15.5	10.2	101.1	0.5	150	7.3	9	39	87
" "	"	"	" 21	10	16.0	9.3	93.6	0.7	23	6.9	82	19	41
Little Coal R. 1/2 mi. above Madison, W. Va.	KB1L1	82.5	May 13	115	16.0	9.6	96.3	0.4	4	7.0		20	
" "	"	"	" 16	94	17.0	9.2	95.0	0.5	9	6.9		18	
" "	"	"	" 21	107	22.0	8.7	98.3	0.4	4	7.0		20	
Little Coal R. 3/4 mi. below Danville, W. Va.	KB1L1	80	May 13	115	15.0	9.7	95.7	0.4	93	6.9	8	20	43
" "	"	"	" 16	94	17.5	10.0	103.3	0.7	240	7.0	2	17	48
" "	"	"	" 21	107	20.5	9.5	104.7	0.7	93	7.2	3	21	45
Coal River 3½ mi. abv. St. Albans, W. Va.	KB1	49	Dec.6'39	31	6.0	11.2	89.4	0.8	4	7.3	8	65	
" "	"	"	" 8	28	4.5	11.4	86.2	1.4	4	7.3	8	65	
" "	"	"	Feb.13'40	656	5.0	12.0	93.4	0.3	23	6.9	70	24	85
" "	"	"	" 28	910	4.0	12.8	97.4	0.5	9	6.6	78	19	
" "	"	"	Mar 14	420	5.0	12.4	96.5	0.4	4	6.5	8	18	72
Coal River, waterworks intake, St. Albans, WVa.	KB1	46	Dec.6'39	31	7.5	4.2	35.4	4.8	36	7.1	12	69	164
" "	"	"	" 8	28	7.0	4.7	38.5	2.4	7	7.1	11	70	
" "	"	"	Feb. 13	656	3.0	12.6	93.1	1.1	4	7.0	135	28	88
" "	"	"	" 28	910	4.0	12.7	96.9	0.4	4	6.3	25	16	
" "	"	"	Mar. 14	420	5.0	12.4	97.2	0.4	4	6.4	4	16	76
Kanawha River, waterwks. intake, Nitro, W. Va.	K	43.6	Jan. 29	1,830	0.0	11.6	79.5	7.3	93	7.1	15	46	
" "	"	"	" 31	2,550	2.0	11.1	80.1	6.8	43	7.5	18	48	
" "	"	"	Feb. 20	26900	3.0	12.3	91.0	1.7	93	6.9	85	21	
Armour Cr. 1/2 mi. abv mouth, Nitro, W. Va.	KAr	44.5	Jan. 29	**	2.0	0.5	3.7	57.8	4,600	6.9	50	95	
Armour Creek, sewage outfall, Nitro, W. Va.	KAr	43.6	Feb. 20	31	5.0	7.8	61.0	25.9	2,400	6.9	110	50	
Kanawha R. 5 mi. below Nitro, W. Va.	K	38.2	Jan. 29	1,830	0.0	12.2	83.4	5.1	15	7.2	14	46	

TABLE K-7 KANAWHA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml.	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
					p.p.m.	% Sat.						
Kanawha R. U.S. Lock, Winfield, W. Va.	K 31.1	Dec.6'39	1,860	9.5	2.0	17.1	5.8	360	7.0	6	65	208
" "	" "	" 8	2,280	9.0	3.4	29.2	2.5	4	7.0	8	66	
" "	" "	" 14	3,020	7.5	3.8	31.4	4.1	7	6.9	6	67	
" "	" "	Jan. 4	1,430	2.5	9.5	69.8	2.5	43	7.0	8	44	
" "	" "	" 10	1,830	1.5	7.6	54.1	4.6	9	6.9	10	47	
" "	" "	" 18	6,570	2.5	7.2	53.1	7.6	75	7.2	17	55	
" "	" "	" 29	1,840	0.5	10.7	74.4	3.1	21	7.0	13	49	
" "	" "	Feb. 13	4,490	4.0	12.8	97.5	2.1	43	7.3	95	28	
" "	" "	" 28	16700	6.0	12.4	99.4	2.4	240	6.9	27	30	
" "	" "	Mar 14	8,600	4.5	11.9	91.5	1.9	150	6.8	16	26	80
Hurricane Creek, below Hurricane, W. Va.	KH 38	Mar. 28		10.0	10.3	91.2	0.8	150	6.7	25	35	
" "	" "	Apr. 4		12.5	9.5	88.8	0.8	43	6.9	47	25	
" "	" "	Aug. 15	3,140	26.0	7.1	86.3	1.5	15	7.2	24	28	
" "	" "	" 17	4,570	26.0	5.0	60.9	2.8	2	7.2	32	28	
" "	" "	" 21	8,400	26.5	4.4	54.2	1.6	2	7.2	8	36	
" "	" "	" 23	6,150	25.5	4.1	49.2	1.4	4	7.4	4	39	
" "	" "	" 29	3,290	25.5	5.0	59.8	1.0	1	7.4	6	50	
" "	" "	" 31	2,940	25.0	5.4	64.1	1.6	2	7.4	11	51	
" "	" "	Sept. 6	2,500	24.5	5.6	66.8	1.1	1	7.4	8	48	
" "	" "	" 12	2,060	24.5	6.0	70.8	1.0	1	7.5	7	51	
" "	" "	" 14	2,050	25.5	6.3	78.2	0.8	2	7.6	7	53	
" "	" "	" 16	1,790	24.0	5.8	67.8	0.6	1	7.5	5	50	
" "	" "	" 20	1,710	23.5	6.1	70.6	0.8	2	7.5	5	49	
" "	" "	" 26	1,700	23.5	6.6	76.4	0.6	**	7.5	4	50	
" "	" "	" 26	1,710	23.0	6.6	75.4	0.8	**	7.6	4	49	
" "	" "	Oct. 2	2,550	20.5	6.7	73.8	0.9	4	7.4	9	44	
" "	" "	Oct. 4	1,900	19.5	7.0	76.1	0.8	**	7.7	8	47	
" "	" "	Oct. 10	1,940	21.0	6.5	72.3	0.7	2	7.7	6	47	
" "	" "	" 12	1,590	20.0	6.7	73.4	0.7	**	7.5	7	44	
" "	" "	" 16	1,650	18.0	7.4	77.5	0.6	5	7.4	8	48	
" "	" "	" 18	1,780	16.5	7.5	75.8	0.7	4	7.4	6	46	
" "	" "	" 24	1,610	15.5	7.7	76.5	0.7	4	7.3	4	50	
" "	" "	" 26	1,540	17.0	7.6	78.1	0.7	4	7.5	4	47	
" "	" "	" 30	1,900	13.5	8.2	78.2	0.8	4	7.3	14	44	
" "	" "	Nov. 1	2,130	13.0	7.8	73.9	0.9	1	7.4	8	56	
" "	" "	" 7	2,100	11.0	8.5	76.7	0.8	2	7.2	12	53	
" "	" "	" 9	2,150	9.0	8.5	73.6	0.9	1	7.2	12	56	
" "	" "	" 13	1,800	7.0	8.9	73.3	0.7	2	7.0	7	57	
" "	" "	" 15	1,600	7.5	8.8	73.1	1.3	2	7.1	6	55	
" "	" "	" 21	1,720	8.5	8.6	73.7	1.1	9	7.4	7	60	
" "	" "	" 27	1,980	5.0	8.4	65.6	0.8	1	7.1	6	61	
" "	" "	" 29	1,860	5.5	8.4	66.3	0.9	2	7.2	8	61	

TABLE K-7 KANAWHA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date	Average Discharge c.f.s.	Temp °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat	5 Day B.O.D. p.p.m.	Coliform M.P.N. Per ml.	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Kanawha River, B&O RR. Bridge	K 0.6	Dec. 5'39	2,090	5.0	7.2	57.3	[illegible]	**	7.2	5	61	
" "	" "	" 7	2,556	5.0	6.9	53.6	5.8	1	7.1	3	61	
" "	" "	" 11	2,450	5.5	7.1	55.9	1.0	**	7.0	5	65	
" "	" "	" 13	3,170	5.5	6.9	54.7	1.0	1	7.1	6	67	
" "	" "	" 19	2,650	5.0	6.8	54.5	1.1	1	7.1	4	67	
" "	" "	" 21	5,110	5.0	7.0	54.4	1.4	1	7.2	[illegible]	66	
" "	" "	" 27	3,130	3.0	6.5	46.5	2.6	2	7.0	[illegible]	60	
" "	" "	Jan. 2'40	2,570	2.5			1.8	2	7.1	8	59	
" "	" "	" 4	1,530	2.0	8.2	59.3	2.3	**	7.1	6	59	
" "	" "	" [illegible]	[illegible]	2.0	5.7	70.3	2.4	1	7.1	7	56	
" "	" "	" 10	2,000	2.0	10.3	74.5	2.7	**	7.0	7	50	
" "	" "	" 16	7,930	1.0	10.8	76.1	3.5		6.9	200	46	
" "	" "	Feb. 15	29500	2.0	13.0	85.3	2.1	9	7.1	180	25	
" "	" "	" 19	22700	2.5	13.0	95.1	2.3	43	6.8	270	22	
" "	" "	" 21	41000	2.5	12.7	92.[illegible]	2.2	15	7.0	160	23	
" "	" "	Feb. 27	11700	2.5	12.5	91.6	1.5	43	7.0	36	29	
" "	" "	" 29	25300	2.5	12.3	90.1	2.2	150	7.0	65	30	
" "	" "	Mar. 4	39300	5.0	12.0	94.0	1.5	36	7.1	190	32	
" "	" "	" 6	45900	5.0	11.4	89.2	1.6	28	7.3	80	29	
" "	" "	" 12	9,100	4.5	12.1	93.2	1.8	93	7.0	34	26	
" "	" "	" 14	9,270	5.0	11.8	91.8	1.0	7	6.9	16	23	
" "	" "	" 18	8,540	5.5	11.3	89.7	1.7	9	7.0	8	33	
" "	" "	" 20	22000	7.0	11.0	90.1	2.1	23	6.8	100	29	
" "	" "	" 26	8,320	5.0	11.1	86.7	1.6	43	6.8	9	24	
" "	" "	Apr. 1	49100	7.0	10.4	85.8	2.3	93	7.0	200	25	
" "	" "	" 3	32800	7.0	10.4	85.2	1.0	460	7.2	70	18	
" "	" "	" 9	16200	10.0	9.3	82.3	1.3	23	6.7	18	22	
" "	" "	" 11	24200	11.0	9.5	86.1	1.8	23	6.7	38	28	

* Seeded and neutralized.

** Less than one.

LITTLE KANAWHA RIVER BASIN

Final Report to the Ohio River Committee

Ohio River Pollution Survey

U. S. Public Health Service
Cincinnati, Ohio
1942

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LITTLE KANAWHA RIVER BASIN

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LITTLE KANAWHA RIVER BASIN*

Syllabus and Conclusions

Syllabus

The Little Kanawha Basin comprises 2,320 square miles of mountainous country in west central West Virginia. The total population is about 90,000 and there are no communities with as many as 2,500 people. The two largest communities have sewage treatment plants. There are no pollution problems that cannot be solved by available methods of waste treatment.

Conclusions

(1) Sewage from 10,200 is discharged to the Little Kanawha River and its tributaries. About 45 percent of the sewage is treated. No industrial wastes enter the stream.

(2) Three public water supplies are taken from streams below sources of pollution.

(3) Primary treatment of sewage now discharged without treatment should be sufficient to maintain good oxygen conditions in the streams.

(4) A summary of cost estimates of remedial measures from Table Lk-1 follows:

Treatment	Capital Cost	Annual Charges
Existing	$190,000	$15,000
Suggested additional	210,000	20,000

Estimated additional costs, over existing charges, of programs involving uniform treatment throughout the basin are:

Primary, all places	$210,000	$20,000
Secondary, all places	290,000	25,000

---

* For maps of this Basin, see Kanawha River Basin.

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Table Lk-1 Little Kanawha River Basin - Estimated Cost of Existing and Suggested Minimum Corrective Measures for Sewage and Industrial Wastes with Comparative Costs for Primary and Secondary Treatment.

	Number of Plants Prim.	Number of Plants Sec.	Population Connected to Sewers	Capital Investment (Dollars)	Annual Charges (Dollars) Amort. & Interest	Annual Charges (Dollars) Operation & Main.	Annual Charges (Dollars) Total
Existing Sewage Treatment	1	1	4,800	190,000	12,000	3,000	15,000
Suggested Minimum Treatment							
Sewage Treatment Plants	6	0	5,300	90,000	10,000	5,000	15,000
Required Interceptors				120,000	5,000	-	5,000
Independent Industrial Waste Correction				-	-	-	-
Total				210,000	15,000	5,000	20,000
Comparative Cost							
Primary Treatment All Waste				210,000	15,000	5,000	20,000
Secondary Treatment All Waste				290,000	18,000	7,000	25,000
As Suggested				210,000	15,000	5,000	20,000

FIG 8a-2

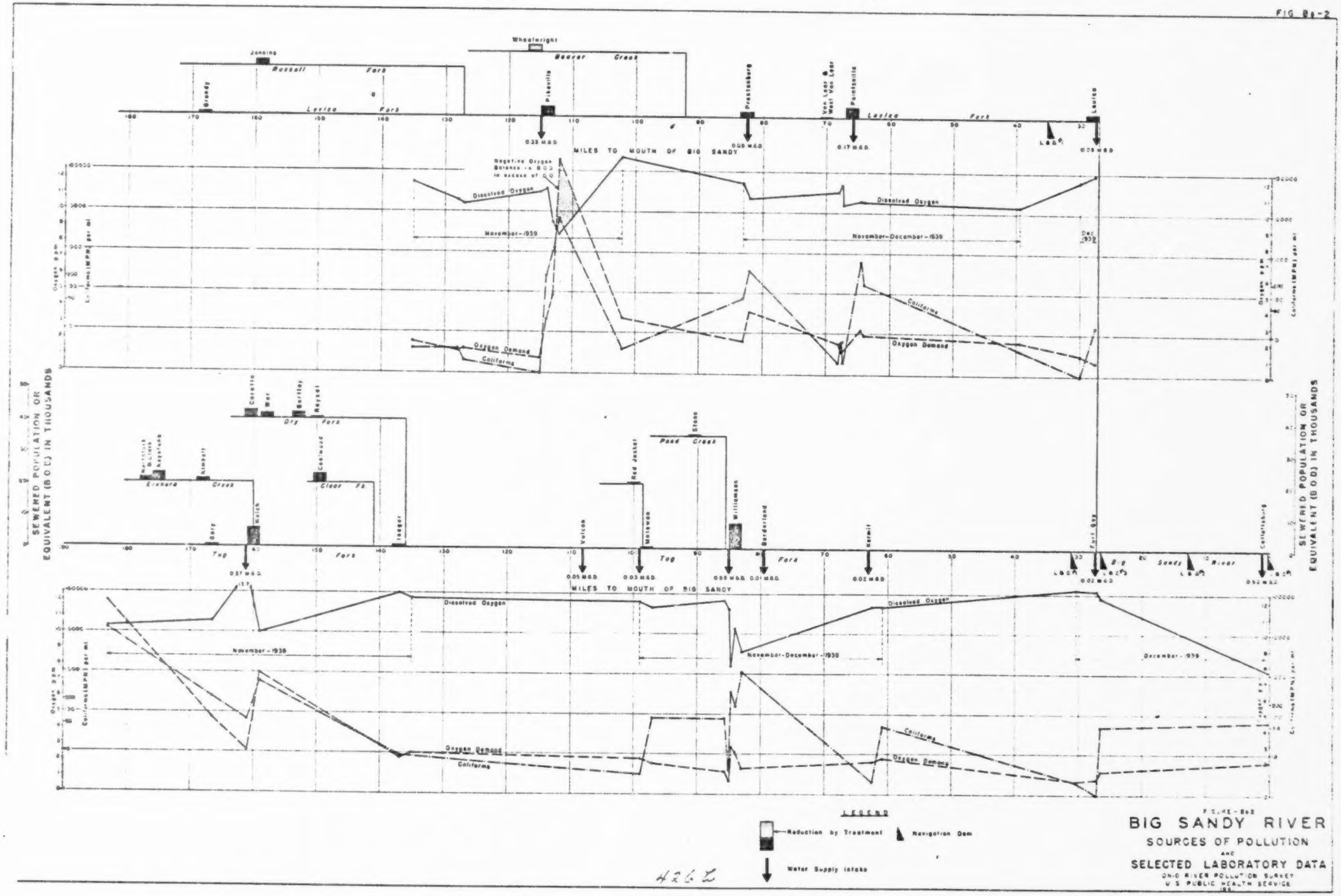

FIGURE-8a2

BIG SANDY RIVER

SOURCES OF POLLUTION

AND

SELECTED LABORATORY DATA

OHIO RIVER POLLUTION SURVEY
U.S. PUBLIC HEALTH SERVICE

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Description

The Little Kanawha River drains 2,320 square miles of mountainous country in the west central part of West Virginia and joins the Ohio River at Parkersburg, W.Va. Most of the area is covered with second-growth timber. A little coal is mined in the eastern part of the basin, and some oil and gas is produced but production is declining. Farming is the principal occupation. The area is sparsely populated and the population has not changed greatly during the past 40 years.

Year	Population
1910	90,441
1920	86,797
1930	86,133
1940	92,355

All of the population is classed as rural, the largest community, Spencer, having a population of 2,497 in 1940. There are seven other communities with more than 500 people.

The principal tributary is Hughes River, which joins the Little Kanawha at mile 19 and drains 530 square miles.

Water Uses - Five locks and dams maintain a navigable channel for boats of 4-foot draft as far as Creston, 48 miles above the mouth. The facilities are not used extensively. The Little Kanawha from Creston to Falls Mills and both forks of Hughes River are considered good bass fishing streams and are extensively used for sport fishing. The State of West Virginia maintains a bass hatchery at Palestine.

Presentation of Field Data

Figure K-1 shows the location and magnitude of each source of pollution of consequence in the Basin. Figure Lk-2 shows similar data and, in addition, the location of water supply intakes from streams below sources of pollution and laboratory data on coliform organisms, dissolved oxygen and B.O.D.

Public Water Supplies - Of the eight public water supplies in the basin, five are from surface sources. These serve 6,600 people, about two-thirds of the total population served by water supplies. Three of the surface supplies are from streams subject to pollution. Table Lk-2 shows data on the surface supplies.

Sewerage - Table Lk-3 shows the sewered population at each source of pollution. Of the 10,200 people connected to sewers, 4,800 are served by the two sewage treatment plants.

Industrial Wastes - There are no sources of industrial wastes in the basin except at Parkersburg, at the mouth. The problem of these wastes is considered with other Ohio River problems.

Table Lk-2 Little Kanawha River Basin - Surface Water Supplie

Supply	State	Source	Mile (1)	Treatment (2)	Pop. Served	Con. M.G.D.
Supplies Below Community Sewer Outfalls						
Grantsville	W.Va.	Little Kanawha R.	78	FD	1,000	0.04
Glenville	"	" " "	103	FD	1,400	0.05
Cairo	"	N.Fk.Hughes R.	39.5	CD	500	0.04
Other Surface Supplies						
Burnsville	W.Va.	N.Fk. Hughes R.	122.5	D	400	0.02
Spencer	"	Imp.& Spring Cr.	59	FD	3,500	0.13
Total - Below Sewer Outfalls					2,900	0.13
Other					3,700	0.15
Total - Surface Water Supplies					6,600	0.28

(1) Miles above mouth of Little Kanawha River.
(2) F - Coagulated, settled, filtered; D - Chlorinated;
C - Coagulated, settled.

FIG Lk-2

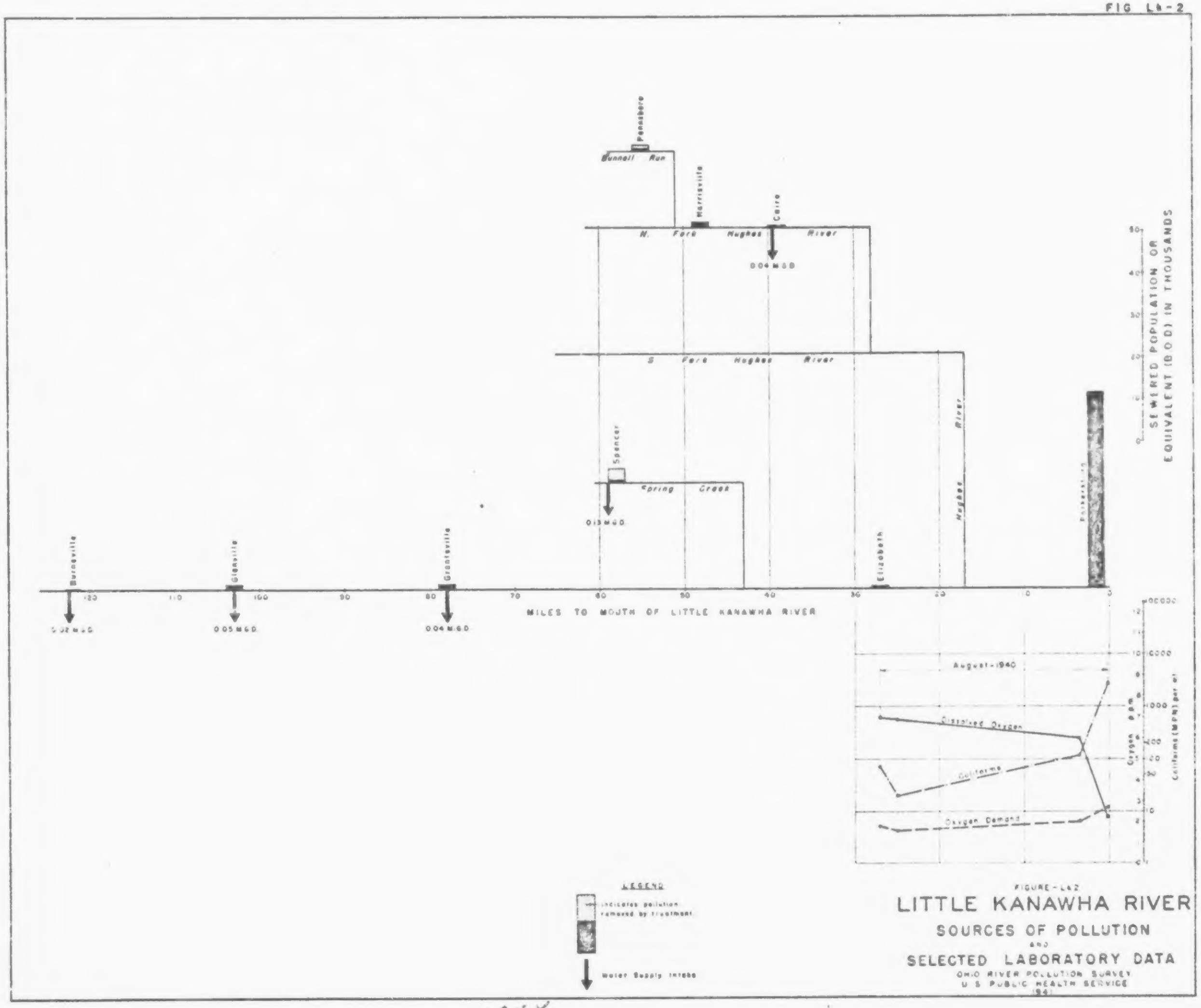

FIGURE-Lk2

LITTLE KANAWHA RIVER

SOURCES OF POLLUTION

AND

SELECTED LABORATORY DATA

OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941

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Table Lk-3 Little Kanawha River Basin - Sources of Pollution, Including Industrial Wastes, Expressed as Sewered Population Equivalents (B.O.D.)

Municipality	State	Receiving Stream	Mile (1)	Population Connected to Sewers	Treatment (2)	Sewered Population Equivalent (B.O.D.)	
						Untreated	Discharged
Elizabeth	W.Va.	Little Kanawha River	27	600	None	600	600
Grantsville	"	" " "	78	1,300	"	1,300	1,300
Glenville	"	" " "	103	1,300	"	1,300	1,300
Burnsville	"	" " "	122	300	"	300	300
Cairo	"	No. Fk. Hughes River	39	500	"	500	500
Harrisville	"	" " " "	48	1,300	"	1,300	1,300
Pennsboro	"	Bunnel Run	55	1,400	Pri.	1,400	900
Reedy	"	Reedy Creek	44	100	None	100	100
Spencer	"	Spring Creek	58	3,400	Sec.(3)	3,400	500
Total				10,200		10,200	6,800

(1) Miles above mouth of Little Kanawha River.
(2) Pri. - Primary, Sec. - Secondary.
(3) Treatment plant under construction at time of laboratory survey.

Presentation of Laboratory Data

Laboratory results for the Little Kanawha River Basin are summarized in Table Lk-7. Selected data are shown in Table Lk-5. All observations were made by the laboratory boat Kiski during the five-month period from May to September, 1940. Ten points were sampled from one to four times monthly. Maps showing the most unfavorable monthly averages of the coliform, dissolved oxygen and oxygen demand results are shown on Figures K-3, K-4 and K-5.

The results for May to July are representative of moderately high discharges and those of August and September are representative of moderately low discharge conditions in the basin. High coliform counts were observed at all stations for at least one month. The highest counts were observed below Spencer and Pennsboro and at the mouth. The latter station showed the influence of Parkersburg's sewage. The dissolved oxygen results were generally better than 6.0 p.p.m. except below Spencer and Pennsboro and at Parkersburg where low monthly averages of about 2.0 p.p.m. were observed at times. Oxygen demand observations were generally less than 2.0 p.p.m. and rarely exceeded 3.0 p.p.m. except below Pennsboro and Spencer where highs of about 16 p.p.m. and 5.0 p.p.m. respectively were observed. Except for more or less uniformly high coliform counts, the Little Kanawha basin does not appear to have any extensive pollution problem.

Biological Summary - The plankton population of the Little Kanawha is quite variable with a tendency to low values. Pollution near the mouth depletes the dissolved oxygen and as a result no fish life exists in this section.

Table Lk-5 Little Kanawha River Basin - Selected Laboratory Data - Main Stream and Tributaries.

River Location	Little Kanawha at Mouth	Little Kanawha above Parkersburg	Little Kanawha Elizabeth		Bunnell Run below Pennsboro
			above	below	
River Miles Above: Mouth of Little Kanawha	0.1	3.5	27	25	63
Period - 1940	Aug.	Aug.	Sept.	Sept.	July
Number of Samples	11	4	3	3	3
Flow in c.f.s.: Sampling Days	671	1,449	45	45	1
Water Temperature °C	25.7	26.8	22.0	22.5	21.5
Coliforms per ml.	2,720	117	12	28	7,130
Dissolved oxygen p.p.m.	2.2	6.0	7.2	7.0	3.7
B.O.D., 5-day, p.p.m.	2.7	2.0	1.6	3.4	15.8

River Location	N. Fork Hughes R. Harrisville		N. Fk. Hughes Water Intake Cairo	Spring Creek Spencer	
	above	below		above	below
River Miles Above: Mouth of Little Kanawha	49	47	40.5	58.5	56.5
Period - 1940	Aug.	Aug.	Aug.	Aug.	Aug.
Number of Samples	4	4	4	4	4
Flow in c.f.s.: Sampling Days	24	24	39	23	23
Water Temperature °C	23.1	23.0	23.6	22.8	22.8
Coliforms per ml.	154	70	218	116	3,350
Dissolved oxygen p.p.m.	6.2	5.9	6.0	4.0	1.7
B.O.D., 5-day, p.p.m.	1.3	1.3	1.3	1.8	5.4

Hydrometric Data

Six stream gaging stations are currently in operation in the Little Kanawha Basin. Table Lk-6 shows monthly mean summer flows for three of the driest years of record at four of these stations.

Table Lk-6 Little Kanawha River Basin - Monthly Mean Summer Flows for Years in Which Lowest Summer Flows have Occurred.

River Location	Little Kanawha River Glenville, W.Va.	Little Kanawha River Grantsville, W.Va.	Little Kanawha River Palestine, W.Va.	Hughes River Cisko, W.Va.
River Miles Above: Mouth of Little Kanawha	103	80	31	28
Drain.Area Sq.Mi.	386	913	1,513	453
Period of Record	1929-40	1929-40	1912-40 (1)	1915-31 1939-40
Year	1930	1930	1925	1930
June c.f.s.	23.9	34.1	1,170	5.72
July "	5.92	7.22	2,520	1.01
August "	1.75	5.18	318	0.12
September "	0.01	0.21	0	0.01
Year	1932	1932	1930	1939
June "	43.4	130	8	235
July "	337	1,150	7	377
August "	27.8	52.4	7	88.3
September "	5.5	12.9	7	6.99
Year	1939	1939	1937	1925
June "	55.5	152	7	84
July "	197	434	7	205
August "	83.9	188	117	26
September "	11.6	16.9	11	14

(1) Accuracy of record fair to poor 1912-37; fair 1938-40.

Proposed Stream Control - The U. S. Engineer Department has determined three reservoir sites to be most nearly satisfactory for flood control storage development; Burnsville on the Little Kanawha River at mile 122.6*, Steer Creek on Steer Creek at mile 85.3*, and West Fork on West Fork at mile 50.1*. Under the proposed plans of operation, the minimum seasonal flows which could be maintained are 10 c.f.s., 7 c.f.s., and 10 c.f.s., respectively. Although increased stream discharge will be beneficial, it is not sufficient to cause any reduction in the sewage treatment required. Hence, the low-flow control which could be provided by the projected reservoirs would have slight tangible value.

---

* River miles above mouth of Little Kanawha River.

Discussion

The Little Kanawha River is only moderately polluted. The largest community, Spencer, has recently installed a secondary sewage treatment plant, and the second-largest one, Pennsboro, has a primary treatment plant which needs some improvements. Primary treatment should be sufficient to maintain good stream conditions at the remaining sources of pollution, except during such an extremely dry year as 1930. Provision against such a remote contingency does not seem justified. Low-flow augmentation by the proposed flood control reservoirs would have no appreciable tangible value.

The estimated cost of the suggested pollution abatement program is summarized on Table Lk-1, together with the estimated cost of existing works and of a program for secondary treatment of all wastes.

TABLE LK-7 LITTLE KANAWHA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage from Mouth		Date 1940		Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
							p.p.m.	% Sat.						
Spring Creek Above Spencer, W. Va. Bridge on Rte. #36	LKS	58.5	June	3	15	21.0	6.9	76.5	1.0	43	6.9	27	48	
" "	"	"	"	12	93	23.0	7.1	81.5	3.9	1,100	6.8	750	37	
" "	"	"	"	20	27	21.0	6.3	70.1	0.5	91	7.0	43	52	
" "	"	"	"	28	144	20.0	8.6	93.3	0.7	43	7.0	45	30	
" "	"	"	July	9	3	21.5	5.2	58.5	1.5	43	6.8	19	60	
" "	"	"	"	17	6	21.5	4.6	52.1	1.4	43	7.1	25	61	
" "	"	"	"	25	416	24.0	5.3	61.8	3.2	930	6.9	1,050	40	
" "	"	"	Aug.	2	15	23.0	4.2	48.5	1.2	0	7.1	51	57	
" "	"	"	"	12	3	24.0	3.2	37.3	1.4	9	7.1	35	71	
" "	"	"	"	20	1	21.0	1.9	21.4	2.4	24	7.0	23	80	
" "	"	"	"	28	70	23.0	6.7	77.2	2.3	430	7.1	410	33	
" "	"	"	Sept.	5	4	21.0	5.4	60.5	0.7	91	7.2	47	57	
" "	"	"	"	13	1	14.0	6.2	60.1	0.6	23	6.7	14	64	
" "	"	"	"	17	1	16.5	5.2	53.0	1.0	4	6.4	12	64	
Spring Creek - 1½ mi. Below Spencer, W. Va.	LKS	56.5	June	3	15	[illegible]	[illegible]	[illegible]	[illegible]	1,100	[illegible]	35	56	
" "	"	"	June	12	93	22.5	3.9	44.9	4.1	1,100	6.2	1,000	34	
" "	"	"	"	20	27	25.0	0.7	8.1	3.3	2,400	7.0	29	65	
" "	"	"	"	28	144	19.5	7.4	80.2	1.1	430	7.0	69	32	
" "	"	"	July	9	3	22.0	2.9	32.7	2.9	36	7.0	13	80	
" "	"	"	"	17	6	22.5	2.0	23.1	3.8	150	7.1	12	84	
" "	"	"	"	25	416	24.0	3.6	42.1	3.9	1,500	6.8	1,100	44	
" "	"	"	Aug.	2	16	24.5	0.1	1.7	6.8	11,000	7.0	105	90	
" "	"	"	"	12	3	24.0	0.7	8.2	6.4	0	7.2	28	114	
" "	"	"	"	20	1	21.5	0.7	7.7	4.8	0	7.1	14	157	
" "	"	"	"	28	70	22.5	5.4	62.2	3.6	2,400	7.0	710	37	
" "	"	"	Sept.	5	4	20.0	0.7	7.5	3.1	230	6.9	13	78	
" "	"	"	"	13	1	15.0	1.6	16.0	2.7	9	6.7	15	102	
" "	"	"	"	17	1	16.5	4.2	42.7	4.4	9	6.5	13	115	
Little Kanawha River 1 mile above Elizabeth, W. Va.	Lk	27	June	3	3,020	19.0	9.3	99.4	1.3	23	7.0	66	20	
" "	"	"	"	12	1,620	26.0	7.6	92.2	1.3	93	6.9	115	30	
" "	"	"	June	20	10,100	21.0	8.5	94.7	1.9	93	7.0	820	23	
" "	"	"	"	28	2,790	22.0	8.5	95.9	1.4	15	7.1	125	30	
" "	"	"	July	9	104	26.5	8.4	103.0	1.0	4	7.1	15	32	
" "	"	"	"	17	262	25.0	7.8	93.4	1.4	4	7.3	8	32	
" "	"	"	"	25	8,250	26.5	7.9	97.2	2.2	110	6.9	555	30	
" "	"	"	Aug.	2	1,280	26.0	7.0	85.8	1.8	240	7.0	500	28	
" "	"	"	"	12	71	29.0	7.6	97.3	2.4	4	7.1	41	33	
" "	"	"	"	20	16	25.5	6.3	75.9	1.4	9	7.4	24	41	
" "	"	"	"	28	1,120	25.0	7.1	84.7	1.6	43	7.1	81	44	
" "	"	"	Sept.	5	75	25.0	7.1	84.4	1.9	24	7.1	46	38	
" "	"	"	"	13	35	19.0	7.0	74.7	1.6	8	6.9	40	37	
" "	"	"	"	17	25	22.0	7.4	84.3	1.4	4	6.9	17	36	
Little Kanawha River Below Dam No. 4 Elizabeth, W. Va.	LK	25	June	3	3,020	18.0	9.5	99.4	1.2	240	7.0	95	20	
" "	"	"	"	12	1,620	26.0	7.5	91.3	1.5	43	7.1	95	26	
" "	"	"	"	20	10,100	21.0	8.1	90.2	1.4	93	6.9	950	22	

TABLE LK-7 LITTLE KANAWHA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage from Mouth	Date	Average Discharge c.f.s.	Temp °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Little Kanawha River below Dam No. [illegible] [illegible], W. Va.	LK 25	June 28	2,790	22.0	8.1	91.4	0.8	43	7.2	172	30	
″ ″	″ ″	July 9	104	26.0	9.5	115.9	1.6	43	7.1	16	32	
″ ″	″ ″	″ 17	[illegible]	24.0	7.9	92.6	1.4	9	7.2	8	32	
″ ″	″ ″	″ [illegible]	8,250	26.0	7.6	52.6	1.7	240	6.9	460	31	
″ ″	″ ″	Aug. 2	1,280	27.0	6.9	85.9	1.2	20	7.1	255	31	
″ ″	″ ″	″ 12	71	23.0	7.6	95.5	2.0	15	7.4	51	33	
″ ″	″ ″	″ 20	16	22.0	6.3	77.1	1.4	4	7.2	18	37	
″ ″	″ ″	″ 28	1,120	25.5	6.6	79.5	1.6	43	7.0	50	48	
″ ″	″ ″	Sept. 5	75	26.0	7.7	92.0	7.0	23	7.2	74	34	
″ ″	″ ″	″ 13	35	21.0	6.4	70.8	1.2	14	6.8	34	36	
″ ″	″ ″	″ 17	25	21.5	7.0	79.0	2.0	46	6.9	16	35	
Bunnell Run - below city limits, Pennsboro, W. Va.	LKHNFB 03	May 31	35	[illegible]	9.1	93.8	1.6	110	6.5	33	31	
″ ″	″ ″	June 10	2	26.0	5.4	114.7	1.5	46	7.6	19	76	
″ ″	″ ″	″ 19	13	19.0	8.8	93.6	0.6	93	7.0	17	40	
″ ″	″ ″	″ 27	1	18.5	[illegible]	95.3	0.8	240	7.4	11	77	
″ ″	″	July 8	**	20.0	4.4	53.0	1.4	1,100	6.9	8	89	
″ ″	″ ″	″ 16	**	20.0	0.0	00.0	39.0	11,000	7.0	55	263	
″ ″	″ ″	″ 24	2	24.5	6.3	74.3	6.9	9,300	7.1	175	86	
″ ″	″ ″	Aug. 1	2	20.5	5.8	63.5	5.3	4,300	7.1	180	101	
″ ″	″ ″	″ 9	**	22.0	5.4	61.0	5.5	4,300	7.1	17	115	
″ ″	″ ″	″ 19	**	21.0	6.4	71.5	6.1	2,300	7.1	475	59	
″ ″	″ ″	″ 27	1	21.0	7.3	80.8	7.3	46,000	7.0	56	75	
″ ″	″ ″	Sept. 4	1	18.0	9.5	99.5	0.8	0	6.9	10	81	
″ ″	″ ″	″ 12	**	15.0	4.0	39.4	21.9	11,000	6.7	14	136	
N.Fk Hughes River bridge above Harrisville, W. Va.	LKHNf 49	May 31	677	17.0	9.3	95.3	1.5	46	6.7	115	21	
″ ″	″ ″	June 10	50	23.5	6.8	79.2	1.8	110	7.4	410		
″ ″	″ ″	″ 19	362	21.0	7.9	87.5	0.9	43	7.1	86	39	
″ ″	″ ″	″ 27	28	19.0	7.2	77.2	0.5	9	7.5	30	43	
″ ″	″ ″	July 8	8	21.5	7.4	83.6	0.4	9	7.2	15	53	
″ ″	″ ″	″ 16	5	22.0	6.7	75.8	1.5	8	7.2	8	55	
″ ″	″ ″	July 24	40	25.0	5.6	66.3	1.6	9	7.1	250	52	
″ ″	″ ″	Aug. 1	65	23.0	6.0	58.7	0.7	23	7.1	19	48	
″ ″	″ ″	″ 9	10	24.5	6.1	72.6	1.2	23	7.5	19	46	
″ ″	″ ″	″ 19	2	22.5	6.1	69.3	1.0	110	7.2	28	50	
″ ″	″ ″	″ 27	18	22.5	6.6	75.7	2.4	460	7.2	480	31	
″ ″	″ ″	Sept. 4	24	20.0	7.4	80.6	0.4	23	7.2	24	45	
″ ″	″ ″	″ 12	3	15.0	8.5	83.4	0.8	4	6.9	14	49	
N.Fk. Hughes River-3/4 mi. below Harrisville	LKHNf 47	May 31	677	15.5	9.2	91.7	1.1	46	6.7	160	21	
″ ″	″ ″	June 10	50	23.5	5.5	64.3	2.7	110	7.4	1,020		
″ ″	″ ″	″ 19	362	21.0	7.7	85.2	0.9	240	7.1	115	28	
″ ″	″ ″	″ 27	28	20.0	7.4	80.6	0.6	15	7.4	39	43	
″ ″	″ ″	July 8	8	21.5	6.8	76.3	0.4	24	7.2	19	54	
″ ″	″ ″	″ 16	5	22.0	6.1	68.7	1.1	15	7.3	15	51	
″ ″	″ ″	″ 24	40	25.0	6.2	73.7	1.1	21	7.3	25	56	
″ ″	″ ″	Aug. 1	65	23.0	5.4	62.5	0.8	9	7.1	42	53	

TABLE Lk-7 LITTLE KANAWHA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
N. Fk. Hughes River 3/4 Mile below Harrisville, W. Va.	LKHNf 47	Aug. 9	10	24.0	6.4	74.8	1.2	8	7.5	19	50	
" "	" "	" 19	2	22.5	5.0	57.7	1.0	24	7.2	15	49	
" "	" "	" 27	18	22.5	6.9	78.5	2.2	240	7.2	220	34	
" "	" "	Sept. 4	24	20.0	7.2	78.0	0.6	23	7.1	31	44	
" "	" "	" 12	3	15.0	7.6	75.0	0.6	2	6.9	15	47	
N. Fk. Hughes River Raw Water Intake Cairo, W. Va.	LKHNf 40.5	May 31	1,100	14.5	9.1	88.3	2.5	110	6.7	230	22	
" "	" "	June 10	82	22.5	6.9	79.3	3.0	460	7.3	830	30	
" "	" "	" 19	588	22.0	7.8	88.9	0.6	73	7.1	87	28	
" "	" "	" 27	46	20.5	7.2	78.7	0.5	43	7.4	50	40	
" "	" "	July 8	13	22.0	7.4	83.8	0.7	93	7.2	19	50	
" "	" "	" 16	8	22.0	7.3	83.0	1.2	23	7.3	13	51	
" "	" "	" 24	65	25.0	5.6	66.5	1.0	23	7.3	12	55	
" "	" "	Aug. 1	106	23.5	4.5	52.3	1.1	110	7.0	47	47	
" "	" "	" 9	16	24.5	6.5	76.8	1.3	93	7.5	74	44	
" "	" "	" 19	4	23.0	6.3	73.0	1.1	240	7.8	14	50	
" "	" "	Aug. 27	28	23.5	6.7	77.7	1.7	430	7.2	169	41	
" "	" "	Sept. 4	38	21.5	7.0	79.1	0.5	36	7.1	50	42	
" "	" "	" 12	4	16.0	8.1	81.5	0.7	45	6.9	15	47	
Little Kanawha River Dam No. 1 - above Parkersburg, W. Va.	LK 3.5	June 3	7,740	18.0	9.4	98.5	1.6	43	6.7	78	19	
" "	" "	" 12	2,370	25.0	7.2	85.7	2.7	460	7.2	55	32	
" "	" "	" 20	12,300	21.5	7.9	88.7	1.4	210	6.9	590	25	
" "	" "	" 28	1,850	23.0	7.8	89.8	0.8	9	7.2	88	31	
" "	" "	July 9	232	27.0	8.7	108.0	2.1	2	7.1	18	32	
" "	" "	" 17	450	25.0	9.6	114.5	2.1	2	7.4	8	32	
" "	" "	" 25	9,600	27.5	7.5	93.6	1.1	75	7.0	115	34	
" "	" "	Aug. 2	3,020	28.0	7.4	94.1	1.2	4	7.1	98	30	
" "	" "	" 12	167	29.5	6.9	89.2	2.7	2	7.4	119	30	
" "	" "	" 20	19	24.5	4.4	52.7	1.5	2	7.2	119	33	
" "	" "	" 28	2,590	25.0	5.4	64.2	2.8	460	6.8	395	38	
" "	" "	Sept. 5	207	25.0	7.5	69.5	2.0	43	7.2	58	39	
" "	" "	Sept.13	57	21.0	6.0	67.1	1.4	4	6.8	39	39	
" "	" "	" 17	41	20.5	5.7	63.1	1.5	4	6.9	52	40	
Little Kanawha River B. & O. R. R. Bridge	LK 0.1	May 2	1,080	12.5	9.1	85.3	3.7	230	6.6	34	19	
" "	" "	" 8	705	15.0	8.8	86.3	3.5	460	6.7	18	23	
" "	" "	" 10	600	15.0	7.9	77.4	3.7	240	6.7	18	20	
" "	" "	" 14	352	16.5	6.6	66.9	2.5	460	6.8	11	27	
" "	" "	" 16	225	16.5	7.9	80.2	2.7	230	7.1	75	27	
" "	" "	" 20	292	17.5	7.3	75.5	2.5	430	6.9	14	20	
" "	" "	" 22	897	18.5	6.9	73.2	3.8	11.000	6.5	7	25	
" "	" "	" 24	1,080	19.0	7.0	74.5	2.9	910	6.5	30	29	
" "	" "	" 28	3,140	19.5	8.4	90.2	1.1	0	6.9	17	28	
" "	" "	June 3	4,170	16.5	9.2	93.5	1.6	1,100	6.8	170	19	
" "	" "	" 5	2,270	18.5	8.0	84.7	1.8	1,100	6.9	65	20	
" "	" "	" 7	1,080	21.0	6.9	77.0	2.1	2,400	6.8	53	23	
" "	" "	" 11	2,180	22.5	6.5	74.3	1.4	430	7.5	470	30	

TABLE Lk-7 LITTLE KANAWHA RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
					p.p.m.	% Sat						
Little Kanawha River B. & O. R. R. Bridge	LK 0.1	June 13	7,750	23.5	7.3	85.1	1.8	430	7.0	480	25	
" "	" "	" 17	3,480	24.5	7.2	84.6	1.4	23	7.2	350	27	
" "	" "	" 19	17,700	22.0	7.9	89.1	2.1	240	7.3	400	27	
" "	" "	" 21	4,050	20.5	8.3	91.2	1.2	150	7.2	530	22	
" "	" "	" 25	2,760	21.5	7.3	82.2	1.9	4,600	7.0	160	26	
" "	" "	" 27	3,020	22.0	7.4	84.4	1.3	2,300	7.0	208	28	
" "	" "	July 1	2,060	21.5	7.4	82.8	2.1	4,300	6.7	165	27	
" "	" "	" 3	1,220	21.5	7.1	79.6	1.2	230	7.0	85	34	
" "	" "	" 11	357	24.5	6.6	77.5	1.6	430	6.9	19	33	
" "	" "	" 15	700	23.5	4.6	53.2	2.6	1,100	7.3	15	29	
" "	" "	" 17	448	23.5	5.0	57.6	2.1	930	7.2	15	30	
" "	" "	" 19	675	25.5	3.3	39.4	5.1	930	6.9	12	23	
" "	" "	" 23	702	27.5	4.3	54.2	1.9	230	7.0	15	33	
" "	" "	" 25	9,570	26.5	6.7	82.7	1.5	230	7.1	23	38	
" "	" "	" 29	1,230	28.5	6.6	84.2	1.7	1,100	6.9	87	28	
" "	" "	" 31	2,920	27.5	4.2	52.2	2.2	930	6.7	175	25	
" "	" "	Aug. 2	1,610	26.0	6.8	82.1	1.4	2,400	7.0	108	26	
" "	" "	" 6	403	28.0	5.6	70.6	1.8	430	6.9	69	33	
" "	" "	" 8	228	26.5	1.2	14.7	2.5	2,400	7.0	62	28	
" "	" "	" 12	167	27.0	2.5	30.6	2.0	930	7.1	58	31	
" "	" "	" 14	85	27.5	1.4	17.5	1.8	91	7.3	74	27	
" "	" "	" 16	48	26.5	0.2	2.1	2.0	240	7.0	60	25	
" "	" "	" 20	19	25.5	0.0	00.0	3.9	4,600	6.9	59	30	
" "	" "	" 22	24	25.0	0.0	00.0	2.8	910	7.2	62	25	
" "	" "	" 26	18	23.5	0.2	2.3	4.2	9,300	7.1	54	23	
" "	" "	" 28	2,590	24.8	0.0	00.0	5.6	4,300	6.7	185	24	
" "	" "	" 30	2,190	23.0	6.4	73.4	1.9	4,300	6.9	360	32	
" "	" "	Sept. 3	560	23.5	4.6	52.9	1.9	930	7.0	150	37	
" "	" "	" 5	207	23.0	2.2	25.6	1.8	430	6.7	94	37	
" "	" "	1941 Jan. 14	1,000	1.5	13.3	94.6	2.4	460	6.6	25	26	
" "	" "	" 16	1,260	3.0	13.0	96.5	3.9	240	6.8	30	23	
" "	" "	" 20	1,700	1.0	13.1	91.8	1.9	93	7.1	50	23	
" "	" "	Jan. 24	5,120	2.5	13.0	95.0	2.2	240	6.9	120	27	
" "	" "	" 28	15,600	3.0	13.1	97.2	1.6	36	6.9	210	17	
" "	" "	" 30	4,830	2.0	9.0	64.7	1.4	43	6.9	150	16	
" "	" "	Feb. 3	1,520	2.0	13.4	96.8	1.6	3	6.7	30	16	
" "	" "	" 5	1,220	1.5	13.4	95.9	2.2	24	6.7	25	17	
" "	" "	" 7	1,140	2.0	13.1	94.7	2.4	43	7.0	20	19	
" "	" "	Mar. 7	1,190	2.0	13.4	95.9	1.6	23	7.0	18	29	
" "	" "	" 11	15,000	2.0	13.6	98.3	3.1	43	7.0	190	24	
" "	" "	" 13	14,400	2.0	13.1	94.4	1.8	43	5.8	480	20	
" "	" "	" 17	2,130	1.5	13.0	92.6	2.2	43	7.0	85	10	
" "	" "	" 19	1,530	1.5	13.4	95.2	1.9	15	6.8	35	14	
" "	" "	" 21	1,430	2.5	13.3	97.3	2.2	24	6.9	25	15	
" "	" "	" 25	1,130	4.0	12.4	94.4	2.3	24	6.7	18	18	
" "	" "	" 27	905	5.0	12.2	95.5	3.0	240	6.7	20	19	
** Less than one.												

BIG SANDY RIVER BASIN

Final Report to the Ohio River Committee

Ohio River Pollution Survey

U. S. Public Health Service
Cincinnati, Ohio
1942

BIG SANDY RIVER BASIN

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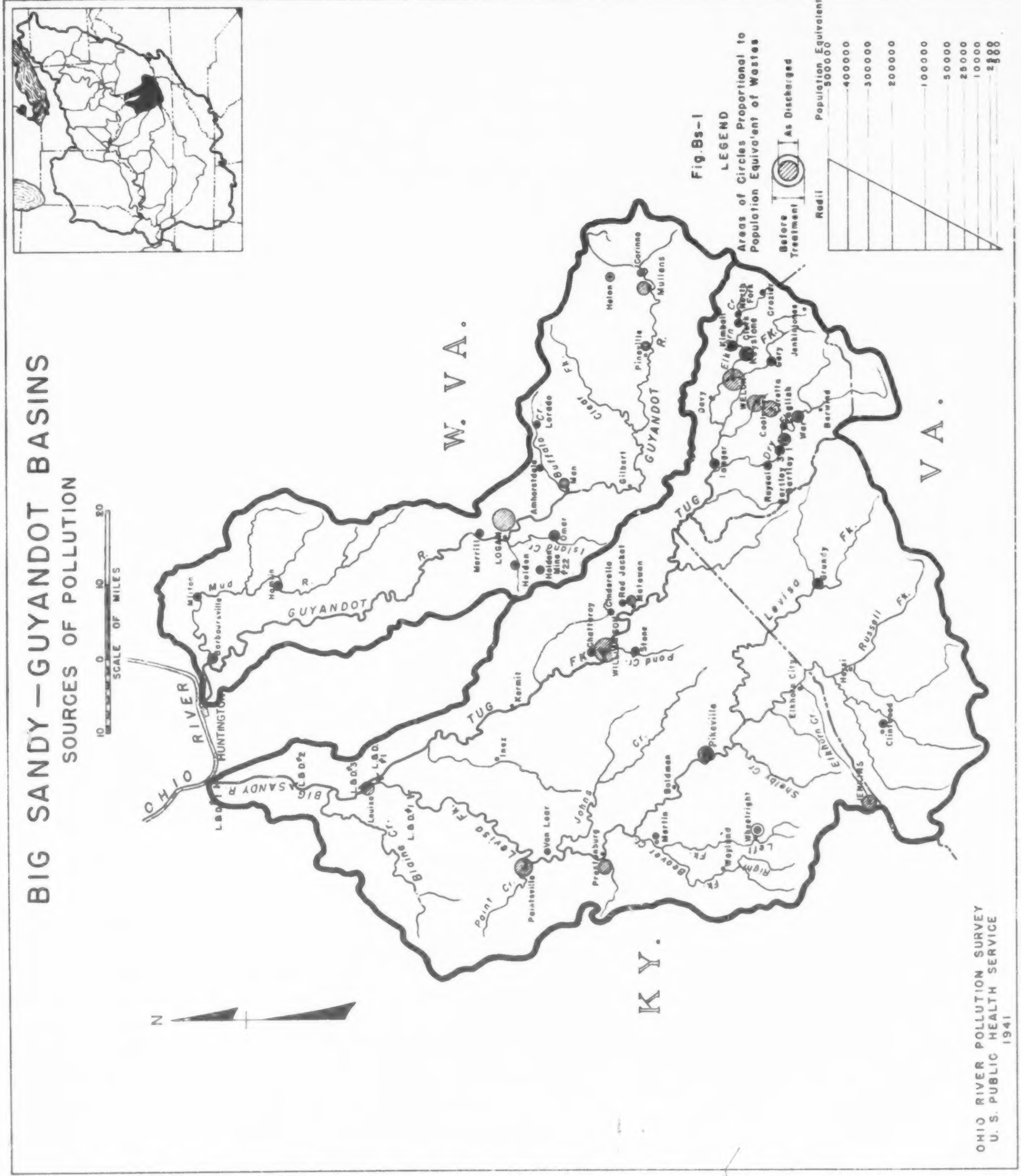
Fig. Bs-1


BIG SANDY — GUYANDOT BASINS
SOURCES OF POLLUTION
SCALE OF MILES
10 0 10 20
N
W. VA.
VA.
KY.
OHIO RIVER
HUNTINGTON
BIG SANDY R.
GUYANDOT R.
TUG FK.
Levisa Fk.
Russell Fk.
Clear Fk.
Buffalo Cr.
Island Cr.
Mud R.
Johns Cr.
Paint Cr.
Blaine Cr.
Elkhorn Cr.
Shelby Cr.
Beaver Cr.
Right Fk.
Pond Cr.
Dry Fk.
Milton
Barboursville
Hamlin
Logan
Man
Amherstdale
Lorado
Gilbert
Pineville
Mullens
Corinne
Helen
Holden
Merrill
Omar
Williamson
Red Jacket
Matewan
Chattaroy
Kermit
Stone
Inez
Louisa
L.&D. No. 1
L.&D. No. 2
L.&D. No. 3
Paintsville
Van Lear
Prestonsburg
Martin
Wayland
Wheelwright
Pikeville
Elkhorn City
Jenkins
Grundy
Haysi
Clintwood
Welch
Keystone
Kimball
Gary
Iaeger
War
Bartley
Berwind
Jenkinjones
Crozier
North Fork
Davy
Fig. Bs-1
LEGEND
Areas of Circles Proportional to Population Equivalent of Wastes
Before Treatment
As Discharged
Radii
Population Equivalent
500000
400000
300000
200000
100000
50000
25000
10000
2500
500
OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941

BIG SANDY RIVER BASIN

Syllabus and Conclusions

Syllabus

The Big Sandy Basin occupies 4,280 square miles in the mountainous section of eastern Kentucky, southern West Virginia, and western Virginia. Coal mining is the only important industry. Less than eight percent of the 410,000 people in the area are in urban communities. Many of the people in rural areas live in mining camps and are served by water supplies. Poor sanitary conditions are found at many places. Sewage causes local nuisances and affects public water supplies. Acid mine drainage damages some small tributaries and coal washeries cause local blackening of several streams. Little progress has been made toward pollution control and there has been slight demand for stream improvement. Techniques are available for abatement of the pollution but the needs of the people in other directions limit present justifiable corrections to the more acute situations affecting larger population groups.

Conclusions

(1) Fifteen surface water supplies are taken from streams below community sewer outfalls. Some of these supplies are seriously polluted by sewage from the community using the water.

(2) Only about 55,000 people are served by sewers and only three communities have sewage treatment facilities. Other than acid mine drainage and coal washery wastes there is no industrial pollution of consequence.

(3) Laboratory studies indicate that high coliform counts are a characteristic at most points. Dissolved oxygen is uniformly high and oxygen demand results were quite generally less than 3.0 p.p.m. Acid conditions were found on two small tributaries but not on any of the larger streams. A greater pollution problem is indicated on Tug Fork than on Levisa Fork.

(4) Flow regulations by proposed flood-control reservoirs studied by the U. S. Engineer Department would have no appreciable effect on the pollution problem.

(5) The two main streams of the Big Sandy Basin, Levisa Fork and Tug Fork, are not heavily polluted. Primary treatment of wastes discharged to these streams should be sufficient to maintain good oxygen conditions at all points except below Grundy on upper Levisa Fork and Welch, W. Va. on Tug Fork.

(6) Local nuisance conditions are caused by the discharge of untreated sewage to a number of tributary streams. Secondary treatment will be required to prevent such nuisances. Considering the present financial condition of most of the towns, justification for the expenditures beyond partial treatment is questionable.

(7) The wastes from coal washeries can be removed by available methods, and the acid mine drainage load can be further reduced by mine sealing.

(8) In view of the normal uses of the streams involved, refined treatment at certain sources of pollution would serve no purpose commensurate with the expenditure. In these instances, lesser treatment appears justified. A summary of cost estimates of remedial measures from Table Bs-1 follows:

Treatment	Capital Cost	Annual Charges
Existing	$70,000	$ 10,000
Suggested additional	1,240,000	110,000

Estimated additional costs, over existing charges, of programs involving uniform treatment throughout the basin are:

Primary, all places	$1,190,000	$105,000
Secondary, all places	1,560,000	150,000

Table Bs-1 Big Sandy River Basin - Estimated Cost of Existing and Suggested Corrective Measures for Sewage and Industrial Wastes, with Comparative Costs for Primary and Secondary Treatment.

	Number of Plants		Population Connected to Sewers	Capital Investment (Dollars)	Annual Charges (Dollars)		
	Prim.	Sec.			Amort. & Interest	Operation & Main.	Total
Existing Sewage Treatment	0	3	2,600	70,000	6,000	4,000	10,000
Suggested Minimum Correction							
Sewage Treatment Plants	20	2	43,600	740,000	50,000	35,000	85,000
Required Interceptors			-	500,000	25,000	-	25,000
Independent Industrial Waste Correction	-		-	-	-	-	-
Total				1,240,000	75,000	35,000	110,000
Comparative Cost							
Primary Treatment All Waste				1,190,000	70,000	35,000	105,000
Secondary Treatment All Waste				1,560,000	100,000	50,000	150,000
As Suggested				1,240,000	75,000	35,000	110,000

Description

The Big Sandy River, only 27 miles long, is formed by the confluence of Tug Fork and Levisa Fork and joins the Ohio River at Catlettsburg, Kentucky. It drains 4,280 square miles, of which 2,280 are in eastern Kentucky, 1,015 in western Virginia and 985 in southern West Virginia. The area is mountainous and most of it is covered with second growth timber. Farming is largely of the subsistence type. Coal mining is the most important industry and this basin includes a large part of the southern Appalachian coal field.

Major Tributaries	Distance Above Mouth of Big Sandy	Drainage Area Square Miles
Blaine Creek	19.9	260
Tug Fork	27.2	1,550
Levisa Fork	27.2	2,330
Russell Fork	127.1	680

Urban Communities	Populations			
	1910	1920	1930	1940
Jenkins, Ky.	-	4,707	8,465	9,428
Williamson, W.Va.	3,561	6,819	9,410	8,366
Welch, W.Va.	1,526	3,232	5,376	6,264
Pikeville, Ky.	1,280	2,110	3,376	4,185
Keystone, W.Va.	2,047	1,839	1,897	2,942
Entire Basin				
Rural	198,310	256,110	317,166	380,720
Urban	3,561	14,758	26,627	31,185
Total	201,871	270,868	343,793	411,905

Less than eight percent of the population lives in urban communities. A large part of the rural population lives in villages and mining camps. The area drained by Tug Fork is the most densely populated part of the basin.

Water Uses - The Big Sandy throughout its length, the lower 12 miles of Tug Fork and the lower 18 miles of Levisa Fork, have been made navigable for boats of 6-foot draft by the construction of five locks and dams. The facilities are little used except near the mouth of the Big Sandy.

The streams are used extensively for recreation by local residents but there are no recreational developments in the area. Some consideration has been given to development of a public park in the scenic area along Russell Fork where it breaks through Pine Mountain at the Virginia-Kentucky border.

Presentation of Field Data

Figure Bs-1 shows the location and magnitude of each source of pollution of consequence in the basin. Figure Bs-2 shows similar data and, in addition, the location of water supply intakes from streams below sources of pollution and laboratory data on coliform organisms, dissolved oxygen and B.O.D.

Public Water Supplies - Of the 120 public water supplies in the basin 18 are wholly or in part from surface sources. These 18 serve 53,800 people, or about 40 percent of the population served by water supplies. Fifteen of the surface supplies come from streams subject to pollution. Table Bs-2 shows data on the surface water supplies. The underground water is limited in quantity and generally of poor quality, hard and often containing objectionable quantities of hydrogen sulfide. A number of the communities use mine drainage as a source of water.

Sewerage - Table Bs-3 shows the sewered population at each of the more important sources of pollution in the basin. Of the 55,000 people connected to sewers, only 2,600 are connected to the three sewage treatment plants in the basin. All of these plants provide secondary treatment.

Industrial Wastes - The only plant in the basin discharging organic industrial wastes is a small meat packing plant at Paintsville. In addition, there are 26 coal washing plants which discharge varying amounts of fine coal particles. All but one of these are in the area drained by Tug Fork. Seventeen of the washeries recirculate wash waters and recover the fines removed by washing. In almost every case black turbidity and deposits on the stream bottom were found below the plants.

Table Bs-2 Big Sandy River Basin - Surface Water Supplies

Supply	State	Source	Mile (1)	Treatment (2)	Population Served	Cons. M.G.D.
Supplies Below Community Sewer Outfalls						
Catlettsburg	Ky.	Big Sandy River	1.0	FD	10,100	0.50
Louisa	"	Levisa Fork	27.5	FD	1,600	0.05
Paintsville	"	" "	65.9	FD	4,000	0.17
Prestonburg	"	" "	82.5	FD	2,500	0.09
Pikeville	"	" "	115.7	FD	3,800	0.33
Fort Gay	W.Va.	Tug Fork	27.3	FD	500	0.02
Kermit	"	" "	62.8	FD	800	0.02
Borderland	"	" "	78.4	FD	200	0.01
Williamson	"	" "	85.4	FD	10,000	0.55
Matewan	"	" "	98.4	FD	500	0.03
Vulcan	"	" "	107	LD	300	0.05
Welch	"	" " -Mine-Wells	161	LD	6,500	0.37
Berwind	"	Dry Fork-Wells	164.5	LD	2,000	0.36
Clinchco	Va.	McClure River	153	FD	1,000	0.03
Elkhorn City	Ky.	Russell Fork	139	None	500	0.03
Other Surface Supplies						
Freeburn	Ky.	Peters Cr.-Mine	106	FD	500	0.02
Jenkins	"	Impounded-Spring-Wells-Mine	-	FD	8,500	0.35
Pound	Va.	Impounded	-	D	500	0.01
Total - Below Sewer Outfalls					44,300	2.61
Other					9,500	0.38
Total - Surface Water Supplies					53,800	2.99

(1) Miles above mouth of Big Sandy River.

(2) F - Coagulated, settled, filtered; I - Iron Removal;
L - Lime-soda softened; D - Chlorinated.

Table Bs-3 Big Sandy River Basin - Sources of Pollution, Including Industrial Wastes, Expressed as Sewered Population Equivalent (B.O.D.)

Municipality	State	Receiving Stream	Mile (1)	Population Connected to Sewers	Treatment (2)	Sewered Population Equivalent (B.O.D.)	
						Untreated	Discharged
Louisa	Ky.	Levisa Fk.-Big Sandy	27	1,600	None	1,600	1,600
Prestonburg	"	" "	82	1,900	"	1,900	1,900
Pikeville	"	" "	114	2,900	"	2,900	2,900
Grundy	Va.	" "	168	1,100	"	1,100	1,100
Williamson	W.Va.	Tug Fork	84	8,000	"	8,000	8,000
Welch	"	" "-Elkhorn Cr.	160	5,900	"	5,900	5,900
Paintsville	Ky.	Paint Creek	66	2,900	"	3,300	3,300
Wheelwright	"	Otter Creek	116	2,000	Sec.	2,000	300
Jenkins	"	Elkhorn Creek	159	2,100	None	2,100	2,100
Bartley #1	W.Va.	Dry Fork	153	1,500	"	1,500	1,500
War	"	" "	158	1,100	"	1,100	1,100
Caretta	"	Barrenshe Creek	160	2,700	"	2,700	2,700
Coalwood	"	Clear Fork	149	3,000	"	3,000	3,000
Kimball	"	Elkhorn Creek	169	1,000	"	1,000	1,000
Keystone	"	" "	175	2,900	"	2,900	2,900
54 smaller sources				14,400	(3)	14,400	14,400
Total - Virginia				2,600		2,600	2,300
Kentucky				15,900		16,300	14,600
West Virginia				36,500		36,500	36,400
Total				55.000		55,400	53,300

(1) Miles above mouth of Big Sandy River.
(2) Sec. - Secondary.
(3) Two towns have septic tanks and subsurface filters. Other places, no treatment.

Presentation of Laboratory Data

The laboratory data for the Big Sandy Basin are summarized in Table Bs-7. Selected data on the main stream and on the tributaries are shown in Table Bs-5.

This basin was covered largely by a mobile laboratory unit operating during the period of October to December, 1939. Samples in the vicinity of Louisa and at the mouth were analyzed at the laboratory boat Kiski at Ashland during an 11-month period from June, 1939 to April, 1940. The stream flow during the period of operation of the mobile laboratory was low but both high and low discharges were observed during the sampling period covered by the Kiski.

Figures Bs-3, Bs-4 and Bs-5 show the location of the sampling points and the coliform, dissolved oxygen and oxygen demand observations. The results thus expressed represent the averages of from one to three individual samples where observations were made by a mobile laboratory unit over short periods of less than one month at each sampling station and represent the most unfavorable monthly average where observations extended over several months.

Rather high coliform counts seem to be characteristic of the streams at most of the sampling points. Nearly half of all stations showed counts of more than 200 per ml. and nearly 65 percent of all stations had counts of over 50 per ml. About half of the samples from above towns had coliform counts of over 50 per ml.

The dissolved oxygen was uniformly high, being above 6.5 p.p.m. except at six stations and the oxygen demand results were quite generally less than 3.0 p.p.m.

Acid stream conditions were observed in Muddy Creek, a tributary of Levisa Fork near Paintsville and along Mate Creek, a tributary of Tug Fork. pH values ranged from 3.9 to 4.8 and phenolphthalein acidities from 39 to 164 p.p.m. None of the larger streams was found to be acid.

Except along Elkhorn Creek above Welch there was considerable evidence of self-purification taking place below sources of pollution. Laboratory determinations show marked reductions of coliform organisms and of oxygen demand in the stretches between sources of pollution. Coliform reductions are less marked during times of high discharge.

Laboratory data indicate a greater pollution problem on Tug Fork, particularly in the area above Iaeger, than on Levisa Fork. Self-purification forces appeared to bring about a reasonable clearance of the streams below sources of pollution during the time of this survey so that the acute pollutional problems in this basin tended to be largely local in their effects.

Biological Summary - Aquatic life is scarce in the Big Sandy for the entire length of the stream. The acid condition of some of the small headwater tributaries is detrimental to the aquatic life in these tributaries and portions of the main stream. Coal washeries have some local damaging effect on plankton. The average plankton volume is less than 1,000 p.p.m. The small towns along the stream do not add sufficient sewage to fertilize the water and the rapid current is not suitable for the development of plankton. Fish are found at the mouth, probably having migrated from the Ohio, but the flesh is contaminated from industrial waste.

Table Bs-5 Big Sandy River Basin - Selected Laboratory Data - Main Stream and Tributaries.

River Location	Big Sandy near Mouth	Tug Fork above	Tug Fork Intake Williamson, W.Va.	Tug Fork below	Levisa Fork above	Levisa Fork Intake Pikeville, Ky.	Levisa Fork below
River Miles Above: Mouth of Big Sandy	0.3	85.7	84.7	84	115	114	113
Number of Samples	9	3	2	2	3	2	2
Flow in c.f.s.: Sampling Days	104	42	40	40	16	15	15
Water Temperature °C.	12.6	5.3	4.5	4.5	5.8	4.3	5.3
Coliforms per ml.	54	81	350	142	1	242	6,700
Dissolved oxygen ppm.	6.1	12.1	8.0	10.3	11.2	11.4	8.6
B.O.D.,5-day p.p.m.	2.1	1.4	2.9	2.6	0.9	3.3	13.2

River Location	Tug Fork above Welch, W.Va.	Tug Fork below Welch, W.Va.	Elkhorn Cr. bel. Jenkins, Ky.	Paint Cr. below Paintsville, Ky.	Elkhorn Cr. bel. Kimball, W.Va.	Clear Cr. below Coalwood, W.Va.	Dry Fork below War, W.Va.
River Miles Above: Mouth of Big Sandy	161	159	158	66	168.6	149	157
Number of Samples	3	3	3	4	3	2	3
Flow in c.f.s.: Sampling Days	9	9	*	2	3	*	7
Water Temperature °C.	6.0	4.0	6.3	4.4	2.0	6.3	7.3
Coliforms per ml.	71	607	2,400	3,100	3,860	2,330	763
Dissolved oxygen ppm.	13.7	10.0	7.2	5.0	10.0	7.6	10.2
B.O.D.,5-day, p.p.m.	2.6	7.5	6.2	12.8	15.9	34.2	6.9

* Less than one.

Fig.Bs-3

BIG SANDY—GUYANDOT BASINS
COLIFORM RESULTS

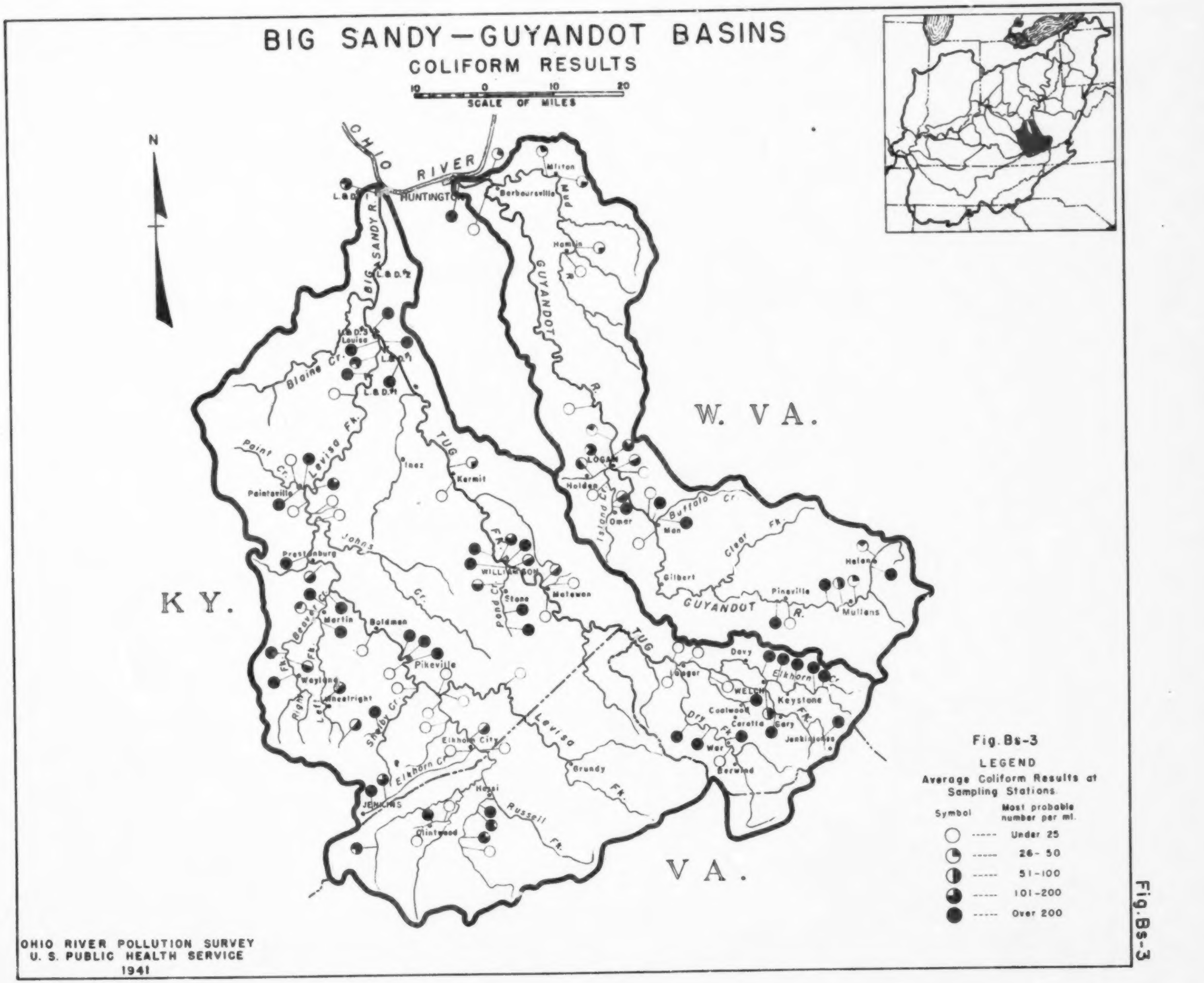
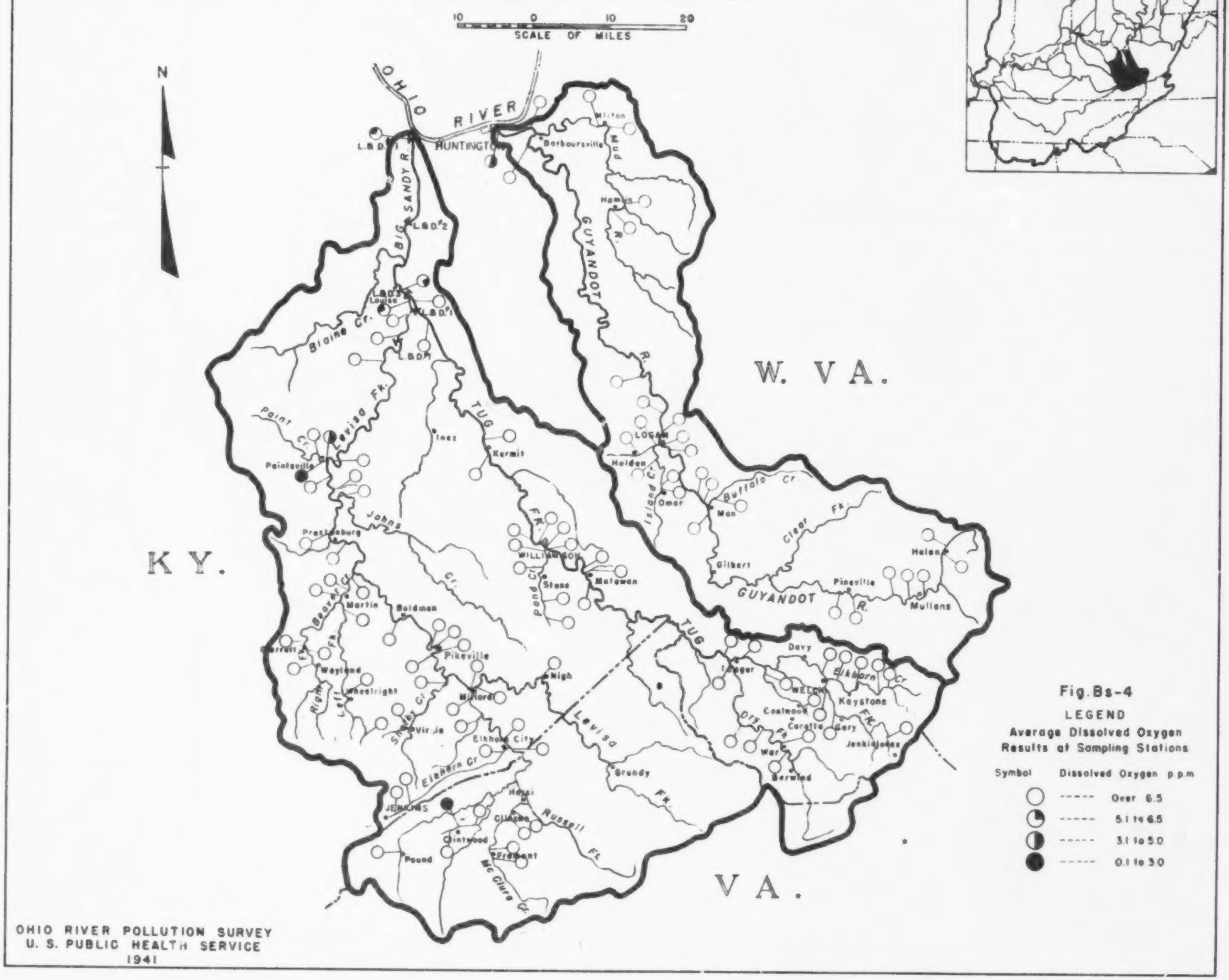

10 0 10 20
SCALE OF MILES
N
OHIO RIVER
HUNTINGTON
BIG SANDY R.
L.&D.1
L.&D.2
L.&D.3
Louisa
L.&D.1
L.&D.11
Blaine Cr.
Levisa Fk.
Paint Cr.
Paintsville
Prestonburg
Inez
Kermit
TUG FK.
Johns Cr.
WILLIAMSON
Pond Cr.
Stone
Matewan
Martin
Boldman
Beaver Cr.
Right Fk.
Left Fk.
Wayland
Wheelwright
Pikeville
Shelby Cr.
Elkhorn City
Elkhorn Cr.
JENKINS
Haysi
Clintwood
Russell Fk.
Levisa Fk.
Grundy
TUG
Davy
Iaeger
WELCH
Elkhorn Cr.
Keystone
Coalwood
Caretta
Gary
Jenkinjones
Dry Fk.
War
Berwind
Milton
Barboursville
Mud R.
Hamlin
GUYANDOT R.
LOGAN
Holden
Island Cr.
Omar
Man
Buffalo Cr.
Clear Fk.
Gilbert
GUYANDOT R.
Pineville
Mullens
Helena
W. VA.
KY.
VA.
Fig. Bs-3
LEGEND
Average Coliform Results at Sampling Stations.
Symbol
Most probable number per ml.
○ ----- Under 25
◔ ----- 26-50
◑ ----- 51-100
◕ ----- 101-200
● ----- Over 200
OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941

Fig.Bs-4

BIG SANDY—GUYANDOT BASINS
DISSOLVED OXYGEN RESULTS


10 0 10 20
SCALE OF MILES
N
OHIO RIVER
HUNTINGTON
L.&D.1
L.&D.2
L.&D.3
Louisa
W.L.&D.1
L.&D.1
BIG SANDY R.
Blaine Cr.
Paint Cr.
Levisa Fk.
Paintsville
Inez
TUG FK.
Kermit
Johns Cr.
Prestonsburg
Beaver Cr.
Martin
Boldman
Garrett
Right Fk.
Left Fk.
Wayland
Wheelright
Pikeville
Shelby Cr.
Vir Je
Millard
Nigh
Elkhorn City
Elkhorn Cr.
JENKINS
Haysi
Clinchco
Clintwood
Fremont
Pound
Mc Clure Cr.
Russell Fk.
Levisa
Grundy
Grundy Fk.
WILLIAMSON
Pond Cr.
Stone
Matewan
TUG
Iaeger
Davy
Elkhorn Cr.
WELCH
Keystone
Coalwood
Caretta
Gary
Dry Fk.
War
Berwind
Jenkinjones
Milton
Mud R.
Barboursville
Hamlin
GUYANDOT R.
LOGAN
Holden
Island Cr.
Omar
Man
Buffalo Cr.
Clear Fk.
Gilbert
GUYANDOT R.
Pineville
Mullens
Helen
W. VA.
KY.
VA.
Fig.Bs-4
LEGEND
Average Dissolved Oxygen
Results at Sampling Stations
Symbol Dissolved Oxygen p.p.m
○ ------ Over 6.5
◔ ------ 5.1 to 6.5
◑ ------ 3.1 to 5.0
● ------ 0.1 to 3.0
OHIO RIVER POLLUTION SURVEY
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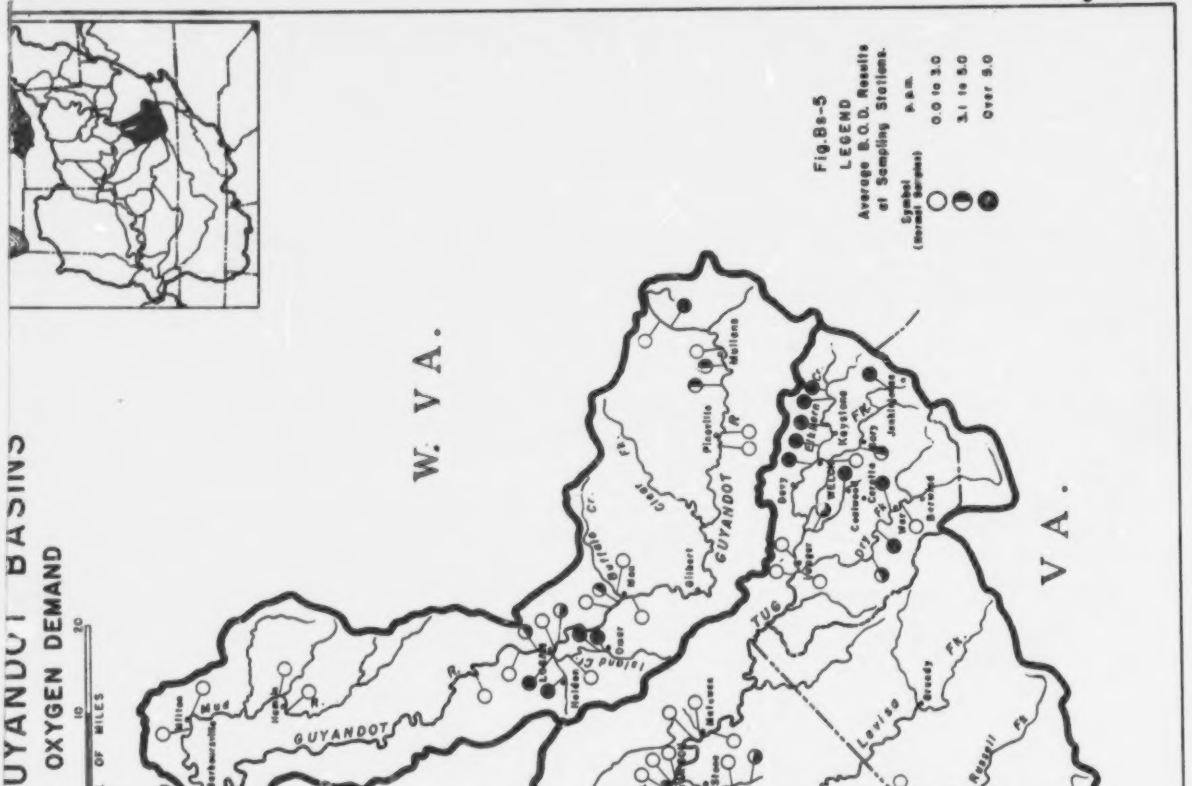
1941

Fig. Bs-5



BIG SANDY—GUYANDOT BASINS
BIOCHEMICAL OXYGEN DEMAND

SCALE OF MILES
10 0 10 20
N
W. VA.
VA.
KY.
OHIO RIVER
HUNTINGTON
GUYANDOT R.
BIG SANDY R.
TUG FK.
LEVISA FK.
WILLIAMSON
PIKEVILLE
Fig. Bs-5
LEGEND
Average B.O.D. Results of Sampling Stations.
Symbol (Normal Surface)
p.p.m.
○ 0.0 to 3.0
◐ 3.1 to 5.0
● Over 5.0

OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941

Hydrometric Data

Five stream gaging stations are currently in operation in the Big Sandy Basin and two others have been discontinued. Table Bs-6 shows monthly mean flows during some of the dryest periods.

Table Bs-6 Big Sandy River Basin - Monthly Mean Summer Flows for Years in Which Low Summer Flows have Occurred.

River Location		Levisa Fork Paintsville, Ky.	Tug Fork Kermit, W.Va.
River Miles Above: Mouth of Big Sandy		66	63
Drain. Area Sq. Mi.		2,150	1,185
Period of Record		1929 - 40	1930 - 40
Year		1930	1930
June	c.f.s.	137	114
July	"	26.5	44.5
August	"	145	78.7
September	"	33.2	29.4
Year		1932	1932
June	"	748	685
July	"	1,076	794
August	"	119	177
September	"	30.4	40.1
Year		1939	1939
June	"	1,010	612
July	"	1,540	1,090
August	"	345	280
September	"	54.7	60.6

Low-flow Regulation - There are no flood-control or hydroelectric reservoirs in the basin although a number of sites on Levisa Fork and its tributaries have been studied by the U. S. Engineer Department.

The locations of some of the possible reservoirs which might also be used for low-flow regulation are shown below:

Name	Stream	Miles Above Mouth of Big Sandy	Drainage Area Square Miles
Fishtrap	Levisa Fork	130	395
Pound	Pound River	150	222
Haysi	Russell Fork	153	155
Wayland	Right Fork Beaver Cr.	121	67
Dewey	Johns Creek	52	207

The Dewey and Fishtrap projects have been found to be most feasible. Under the proposed plan of operation the minimum seasonal flows could be increased by 2 c.f.s. from Dewey and about 100 c.f.s. from Fishtrap. This added flow would benefit stream reaches below the dam sites but is not sufficient to allow a reduction in the amount of treatment required. Hence, low-flow control originating at these projects would have little tangible value.

Discussion

Because of the extensive use of Tug Fork and Levisa Fork as sources of water supply the need for sewage treatment to reduce bacterial pollution is greater than in many other parts of the Ohio Basin. A number of the water supplies, outstanding among which are Williamson and Pikeville, are subject to pollution from the town's own sewage.

The pollution control problem is particularly difficult because of the many mining camps which are only partly sewered and for which the provision of interceptors and treatment plants would be quite expensive. The lack of other community facilities, the high indebtedness, and the lack of permanence of many of the communities are factors to be considered. Although there is ample apparent justification for an adequate pollution control program, the difficulty of financing remedial works necessitates careful examination of the relative benefits and costs of each project.

At the communities along Levisa Fork below Russell Fork primary treatment of all sewage should be sufficient to maintain excellent dissolved oxygen conditions in the stream. This applies also to Paintsville which would, presumably, intercept the wastes now discharged to Paint Creek and discharge them, after treatment, to Levisa Fork. At Williamson and at the smaller communities along Tug Fork below Welch primary treatment should be sufficient.

At Grundy on upper Levisa Fork and at Welch on Tug Fork at the confluence of Elkhorn Creek, as well as at the numerous towns on tributaries of the two main streams, secondary treatment will be necessary if nuisance conditions are to be eliminated during the dry summer months. The receiving streams at all of these places are subject to flows approaching zero. At the two larger communities, Grundy and Welch, the problem involves a larger population and is more acute. As a logical starting point, installation of secondary treatment is suggested at these two points. As far as the balance of the pollution is concerned, it is suggested that a partial treatment be installed at all places where as many as 500 people are discharging sewage. Such treatment should do much toward reducing the effects of the sewage on downstream water intakes. Secondary treatment facilities can be added at these places as community finances permit.

The practice of disposing of garbage and other refuse by dumping it along the stream banks or into the streams is common in this area. Unless this practice is changed, even the provision of sewage treatment will not maintain the streams in good condition. There are also many privies built over the streams or along stream banks where their contents can easily enter the streams. Much progress has been made with W.P.A. assistance in building sanitary privies but the program is not complete.

The elimination of pollution by coal washery wastes presents no particular technical problems. Methods now in use in other places permit the recovery of virtually all of the fine material now entering the streams. At the time a demand develops for control of this largely visual pollution, proper corrective measures should be taken.

Acid mine drainage does not affect any of the larger streams. Completion of the program of sealing abandoned mines will help to improve conditions in those tributaries which are still acid.

Flow regulation by the proposed flood-control reservoirs would have no appreciable effect on the need for the suggested pollution abatement program. The estimated cost of the suggested pollution abatement works for the Big Sandy Basin has already been presented in Table Bs-1.

TABLE Bs-7 BIG SANDY RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Miles from Mouth	Date 1939	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml.	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Tug Fork, below Jenkinjones, W. Va.	BsT 183	Nov. 9		7.0	10.3	84.4	13.8	2,400	7.6	140	101	1,062
" "	" "	" 14		4.5	10.5	80.9	10.2	21,000	7.8	32	118	
Tug Fork, below Gary, W. Va.	BsT 166.5	Nov. 9		9.0	11.3	97.2	5.7	240	7.6	5	139	1,080
" "	" "	" 14		5.0	10.1	78.5	3.7	240	7.7	3	121	
Tug Fork, above Welch, W. Va.	BsT 161	Nov. 9		9.0	14.8	127.5	2.6	9	7.5	5	163	494
" "	" "	" 14		7.0	14.5	119.2	2.2	110	8.4	7	177	
" "	" "	" 17		2.0	11.9	86.2	3.1	93	7.9	8	201	
Elkhorn Creek below North Fork, W. Va.	BsTE 176.5	" 9		1.5	11.8	84.0	11.0	2,400	8.3	65	306	1,020
" "	" "	" 14		1.5	11.7	83.3	13.7	7,500	8.3	105	291	
" "	" "	" 17		1.0	12.4	86.9	8.8	4,300	8.2	65	302	
Elkhorn Creek, below Keystone, W. Va.	BsTE 175	Nov. 9		1.5	10.3	73.3	13.9	2,400	8.4	260	291	910
" "	" "	" 14		1.5	10.9	77.5	14.3	3,600	8.3	280	287	
" "	" "	" 17		3.0	9.3	68.9	14.1	2,400	8.4	35	325	
Elkhorn Creek below Kimball, W. Va.	BsTE 168.6	Nov. 9		2.0	9.8	70.4	10.0	2,400	8.6	500	301	894
" "	" "	" 14		1.5	10.0	71.3	11.9	4,600	8.4	430	317	
" "	" "	" 17		2.5	10.4	76.1	9.9	4,600	8.4	185	326	
Elkhorn Creek, above Welch, W. Va.	BsTE 161	Nov. 9		2.5	11.4	83.6	5.1	240	8.1	93	295	818
" "	" "	" 14		3.0	11.5	85.4	6.3	430	8.4	120	307	
" "	" "	" 17		2.5	11.7	85.4	5.6	390	8.3	91	225	
Tug Fork below Welch, W. Va.	BsT 159	Nov. 9			8.8		11.4	460	8.1	18	275	1,020
" "	" "	" 14		5.5	10.8	85.0	4.8	930	8.1	28	337	
" "	" "	" 17		2.5	10.5	76.7	6.2	430	8.1	63	279	
Clear Fork, below Coalwood, W. Va.	BsTCf 149	Nov. 10		5.0	2.5	19.7	63.0	4,300	7.2	38	275	395
" "	" "	" 15		7.5	12.6	104.6	5.3	360	7.3		25	177
Clear Fork at mouth	BsTCf 141	Nov. 15		1.0	11.4	79.8	4.8	**	7.5	12	140	
" "	" "	" 20		9.5	10.3	90.1	3.2	**	7.5	12	133	
Tug Fork, above Iaeger, W. Va.	BsT 137	Nov. 10		9.5	13.0	113.1	1.8	21	8.4	3	240	235
" "	" "	" 15		1.0	12.6	88.8	2.3	2	8.3	3	284	
" "	" "	" 20		7.5	11.9	98.7	2.5	4	8.4	7	245	
Dry Fork, above War, W. Va.	BsTDf 159	Nov. 10		5.0	12.3	96.2	1.4	43	7.6		127	195
" "	" "	" 15		6.0	12.5	99.8	1.2	4	8.2	7	165	
" "	" "	" 20		8.5	10.1	85.8	2.2	9	8.0	3	134	
Dry Fork below War, W. Va.	BsTDf 157	Nov. 10			11.5		4.2	930	7.6	7	138	295
" "	" "	" 15		5.0	10.7	83.8	5.4	430	7.6	2	152	
" "	" "	" 20		9.5	8.4	73.6	11.1	930	7.7	3	152	
Dry Fork, above Bartley, W. Va.	BsTDf 154	Nov. 10		6.5	12.8	103.9	4.0	93	8.1	5	211	215
" "	" "	" 15		2.0	10.1	72.7	6.6	460	7.9	18	236	
" "	" "	" 20		9.0	11.2	96.2	5.8	460	7.9		220	

TABLE Bs-7 BIG SANDY RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1939	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Dry Fork below Raysal, W. Va.	BsTDf 150	Nov. 10		8.0	11.6	97.7	3.6	2,400	8.4	115	246	185
" "	" "	" 15		2.0	10.7	77.5	6.3	1,500	8.1	7	281	
" "	" "	" 20		10.5	8.1	72.3	4.9	2,300	8.2	215	245	
Dry Fork, above Iaeger, W. Va.	BsTDf 137	Nov. 10		8.0	12.4	104.4	2.0	4	8.3		214	315
" "	" "	" 15		2.0	12.5	90.5	1.9	1	8.3	2	229	
Tug Fork, below Iaeger, W. Va.	BsT 135	Nov. 10		10.0	12.9	114.1	1.7	36	8.4	10	235	245
" "	" "	" 15		2.0	12.2	88.4	2.7	110	8.4		244	
" "	" "	" 20		8.0	11.4	96.2	3.2	1,100	8.4	5	247	
Tug Fork, above Matewan, W. Va.	BsT 99	Nov. 24		6.5	11.5	93.7	2.0	4	7.7	5	222	170
" "	" "	" 29		3.0	12.4	92.1	2.4	1	7.6	2	198	
Mate Creek, above Matewan, W. Va.	BsTM 99	Nov. 24		7.0	12.1	99.5	1.6	1	3.9			830
Mate Creek, at mouth	BsTM 98.5	Nov. 24		6.5	12.4	100.3	1.9	4	4.0	8		780
" "	" "	" 29		1.0	14.0	98.2	2.0	2	4.1			
" "	" "	Dec. 4		3.5	11.6	87.3	2.0	1	4.0	2		
Tug Fork, below Matewan, W. Va.	BsT 97	Nov. 24		6.5	11.3	91.6	2.4	230	7.5	7	173	190
" "	" "	" 29		2.5	12.4	90.6	2.3	7	7.5	8	188	
" "	" "	Dec. 4		3.0	11.5	85.5	1.0	9	7.5	5	192	
Pond Creek, 1/2 mile below McVeigh, Ky.	BsTP 95.5	Nov. 8		7.5	8.6	73.5	8.3	2,400	7.6	51	196	
" "	" "	" 15		2.0	11.8	85.1	1.6	2,400	7.8	6	246	
Pond Cr. below mouth of Pinson Fk, McAndrew, Ky.	BsTP 93.5	Nov. 8		9.0	12.1	104.0	3.5	1,100	7.8	9	226	
" "	" "	" 15		1.5	12.7	90.3	1.7	43	7.8	4	247	230
Pond Creek, 1 mile below Stone, Kentucky	BsTP 89.5	Nov. 8		10.0	11.5	101.3	1.7	93	8.0	6	219	
" "	" "	" 15		2.0	13.1	94.4	2.0	43	7.9	5	225	181
Pond Creek, 100 yds. abv. mouth, Williamson, WVa	BsTP 85.3	Nov. 8		7.5	10.5	87.5	1.9	460	7.4	15	185	
Pond Creek, at mouth	BsTP 85.3	Nov. 29		2.0	13.0	93.7	2.9	460	7.4	25	204	160
" "	" "	Dec. 4		4.0	11.6	88.3	1.5	4	7.6	12	204	
Tug Fork above Williamson, W. Va.	BsT 85.7	Nov. 29		3.5	12.7	95.2	2.1	**	7.8	3	178	180
" "	" "	Dec. 4		4.5	11.6	89.5	0.8	240	7.9	3	190	
" "	" "	" 6		8.0	11.9	100.3	1.4	4	7.6	2	182	
Tug Fork, upper edge of Williamson, W.Va.	BsT 85.0	Nov. 8		7.0	11.6	95.0	0.8	4	7.8	5	176	
Tug Fork, waterworks intake, Williamson,	BsT 84.7	Nov. 29		4.0	3.6	27.6	3.4	240	8.4	7	168	190
" "	" "	Dec. 4		5.0	12.4	96.6	2.4	460	8.1	5	191	
Tug Fork, below Williamson, W. Va.	BsT 84	Nov. 29		4.5	11.5	88.7	3.6	43	7.6	3	168	180
" "	" "	Dec. 4		4.5	9.1	69.9	1.6	240	7.6	2	182	

TABLE Bs-7 BIG SANDY RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage from Mouth	Date 1939	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliform M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Tug Fork, 1 mile below sewage Williamson, W.Va.	BsT 83	Nov. 8		8.0	8.9	75.3	1.6	1,100	7.7	5	179	
Tug Fork above Kermit, W. Va.	BsT 63	Nov. 24		6.0	10.8	86.6	2.5	2	7.8	5	153	230
" "	" "	" 29		4.5	12.6	97.1	2.5	2	7.6	5	158	
" "	" "	Dec. 4		4.5	11.7	90.0	1.1	2	7.6	5	159	
Tug Fork, below Kermit, W. Va.	BsT 61	Nov. 24		6.5	10.8	87.4	2.3	36	7.6	5	154	220
" "	" "	" 29		5.0	12.8	99.8	2.7	4	7.6	3	146	
" "	" "	Dec. 4		4.0	11.6	86.3	1.6	110	7.5		152	
Tug Fork, Station 3.8 Dam #1	BsT 30.3	June 23		27.0	6.6	81.8	2.1	75		900	34	
" "	" "	Aug. 4		27.0	7.4	91.7	0.6	24				
" "	" "	" 18		26.0	7.1	86.4	75.					
" "	" "	Sept 1		24.0	7.2	84.6	0.8	23	7.8	5	78	
" "	" "	" 15		24.5	7.0	82.6	0.7	4				
" "	" "	" 29		23.0	7.7	88.6	0.6	4				
" "	" "	Oct. 13		14.0	9.1	87.6	1.0	4				
" "	" "	" 27		20.0	7.7	84.0	0.9	1				
" "	" "	Nov. 10		6.0	11.4	91.4	0.5	**				
" "	" "	" 24		7.0	11.4	93.8	1.0					
" "	" "	Dec. 8		4.5	12.0	92.4	0.6	1				
" "	" "	" 29		1.5	13.6	97.0	0.9	2				
" "	" "	1940 Feb. 9		2.5	13.2	97.0	0.6	2				
" "	" "	Feb. 13		5.5	11.4	92.6	1.4	21				
" "	" "	Mar. 8		4.5	12.0	92.4	0.5	93				
" "	" "	Apr. 5		14.0	9.2	88.7	0.8	240				
Tug Fork, Station 0.1 Fort Gay, W. Va.	BsT 27.2	July 7		25.0	6.8	81.1	1.2	1,100	7.3	260	26	
" "	" "	" 21		22.5	7.4	84.2	1.4	240	7.2	350	28	
" "	" "	Aug. 4		25.5	7.3	87.7	0.6	46	7.5	85	42	
" "	" "	" 18		26.0	6.5	79.6	1.5	43	7.5	220	64	
" "	" "	Sept. 1		25.0	8.0	96.1	1.4	23				
" "	" "	Sept. 15		25.0	7.5	89.5	0.6	4	7.9	7	85	
" "	" "	" 29		23.5	8.2	95.5	0.7	**	8.0	3	114	
" "	" "	Oct. 13		19.0	8.4	89.3	0.9	4	8.0	8	124	
" "	" "	" 27		18.0	8.6	89.9	0.8		7.8	12	110	
" "	" "	Nov. 10		7.5	9.9	82.1	1.1	21	7.7	17	89	
" "	" "	" 24		7.5	10.1	84.1	1.0	4	7.6	7	113	
" "	" "	Dec. 8		4.5	12.2	93.7	0.5	1	7.4	7	135	
" "	" "	" 29		2.0	13.3	96.0	1.2	2	7.4	7	76	
" "	" "	1940 Feb. 9		2.0	13.1	94.8	0.9	**	6.8	21	66	
" "	" "	" 13		6.5	11.3	92.8	2.0		7.6	110	53	
" "	" "	Mar. 8		4.5	12.0	92.4	0.5	23	6.8	37	26	
" "	" "	Apr. 5		13.0	9.2	86.7	0.9	93	6.5	95	30	
Levisa Fork, at bridge High, Ky.	BsL 135	Nov. 14		7.5	11.8	98.3	1.9	4	7.2	8	43	112
Levisa Fork, above Russell Fork	BsL 128.1	Nov. 6		5.5	10.7	84.9	1.4	4	7.2	30	39	

TABLE Be-7 BIG SANDY RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1939	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Levisa Fork, at mouth of Russell Fork	BeL 127.1	Nov. 13		6.0	10.5	84.5	1.5	2	7.0	15	39	
McClure River, 100 yds. above Fremont, Va.	BeLRMc 160	Nov. 10		8.5	10.0	85.6	1.2	23	7.8	8	188	141
McClure River, below Fremont, Va.	BeLRMc 159	Nov. 7		6.0	11.9	95.7	1.3	150	8.0	12	207	
McClure River, waterwks. intake, Clincho, Va.	BeLRMc 153	Nov. 7		5.5	11.2	88.5	1.1	93	7.8	10	208	
"	" "	" 10		8.0	10.9	91.8	1.1	150	7.9	7	207	180
McClure R. lower edge of Clincho, Va.	BeLRMc 152	Nov. 7		5.5	8.6	67.8	4.0	2,400	7.7	18	190	
"	" "	" 10		8.0	8.1	68.0	5.4	430	7.7	5	198	203
"	" "	" 16		4.5	9.0	69.0	5.2	430	7.7	13	178	
Holly Cr. lower edge of Clintwood, Va.	BeLRPCH 162	Nov. 7		10.5	0.0	00.0	130.	240,000	7.2	190	424	
"	" "	" 10		10.0	0.0	00.0	150.	1,100,000	7.4	155	462	172
"	" "	" 16		9.0	1.4	12.5	168.	2,400	7.4	550	255	
Holly Creek, 3 miles below Clintwood, Va.	BeLRPCH 159	Nov. 16		1.5	12.0	85.9	0.7	4	7.1	8	58	
Pound River 3/4 mi. below Pound, Va.	BeLRP 171.3	Nov. 7		8.0	8.7	73.0	3.5	43	6.9	65	69	
"	" "	" 10		6.0	7.3	58.3	2.2	240	6.8	27	62	132
Russell Fork above Elkhorn City, Ky.	BeLR 140	Nov. 6		5.5	12.1	95.5	1.0	4	7.6	12	92	
"	" "	" 13		5.0	11.4	89.5	1.4	1	7.6	10	99	127
Elkhorn Cr. 1 mi. below Jenkins, Ky.	BeLRE 158	Nov. 7		10.0	7.3	64.5	6.7	2,400	7.5	13	296	
"	" "	" 10		6.5	6.6	53.2	5.4	2,400	7.7	7	207	
"	" "	" 16		2.5	7.6	56.0	6.7	2,400	7.6	10	269	
Elkhorn Creek 3 miles below Jenkins, Ky	BeLRE 156	Nov. 7		9.5	17.6	153.8	3.7	240	8.5	5	258	
"	" "	" 10		5.5	9.8	77.8	3.2	93	7.8	5	264	284
Elkhorn Cr. at mouth, above Elkhorn City, Ky.	BeLRE 140	Nov. 6		2.5	13.6	99.6	0.8	23	7.9	6	138	
"	" "	" 13		4.0	13.1	99.4	0.8	4	7.9	5	139	204
Russell Fork, below Elkhorn City, Ky.	BeLR 138	Nov. 6		6.0	11.9	95.6	2.2	43	7.7	8	103	
"	" "	" 13		7.0	11.1	91.4	2.4	93	7.6	8	108	
Marrowbone Cr. at mouth Marrowbone, Ky.	BeLRM 134	Nov. 13		3.0	12.0	88.9	0.8	7	7.2	4	67	160
Russell Fork, above Millard, Ky.	BeLR 128	Nov. 6		6.0	11.3	90.6	1.0	4	7.5	18	78	
"	" "	" 13		6.0	10.9	87.5	1.4	1	7.4	12	83	126
Long Fork, 200 yds. abv mouth, Virgie, Ky.	BeLSL 132	Nov. 9		2.0	12.3	89.2	0.6	210	7.1	4	41	
"	" "	" 14		1.5	12.5	88.9	0.7	91	7.0	4	42	82
Shelby Creek, at mouth Shelbiana, Ky.	BeLSL 121	Nov. 6		3.5	12.3	92.3	0.6	4	7.4	48		15
"	" "	" 13		4.5	11.4	87.6	1.8	2	7.2	4	47	171

TABLE Bs-7 BIG SANDY RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth		Date 1939	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml.	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
						p.p.m.	% Sat.						
Levisa Fork, 1/2 mile above Pikeville, Ky.	BsL	115	Nov. 9		5.0	11.3	88.0	0.6	4	7.3	18	63	
"	"		" 14		8.5	11.3	96.6	1.0	**	7.4	24	68	131
"	"	"	" 15		4.0	11.1	84.7	1.2	1	7.3	8	67	134
Levisa Fork, waterworks intake, Pikeville, Ky.	BsL	114	Nov. 14		4.0	11.2	85.6	4.0	23	7.3	15	66	123
"	"	"	" 15		4.5	11.5	88.6	2.6	460	7.3	23	69	
Levisa Fork, lower edge of Pikeville, Ky.	BsL	113	Nov. 9		8.0	8.6	72.6	3.6	1,100	7.2	12	65	
"	"	"	" 14		10.5	10.8	96.1	6.3	930	7.3	20	74	140
"	"	"	" 15		7.0	8.9	72.9	4.5	1,100	7.2	20	75	140
Levisa Fork 100' below main sewer, Pikeville, Ky	BsL	113	Nov. 14		4.5	8.0	62.0	10.5	2,400	7.1	20	75	153
"	"	"	" 15		6.0	9.3	74.2	16.0	11,000	7.1	35	89	161
Levisa Fork, under bridge below Boldman, Ky.	BsL	102	Nov. 9	19	12.0	13.4	123.6	3.4	4	7.9	16	67	
L. Fk. Beaver Cr. lower edge of Weeksbury, Ky.	BsLBLf	102.5	Nov. 9		2.5	13.9	108.0	0.7	9	8.0	6	288	
"	"	"	" 14		2.5	14.3	104.8	1.0	110	8.2	4	268	183
L. Fk. Beaver Cr. lower edge Wheelwright, Ky.	BsLBLf	116	Nov. 9		3.0	11.8	87.3	4.5	93	7.7	14	191	
"	"	"	" 14		3.5	11.3	84.7	5.7	240	7.8	25	202	467
L. Fk. Beaver Creek, 100 yds. above mouth	BsLBLf	96.5	Oct. 30		10.5	10.6	94.5	0.7	460	7.5	28	78	
"	"	"	Nov. 1		8.5	11.1	95.0	0.5	9	7.4	5	94	
R. Fk. Beaver Cr. lower edge Wayland, Ky.	BsLBRf	113	Oct. 30		9.5	9.8	85.2	1.5	460	7.1	47	52	
"	"	"	Nov. 1		7.5	9.4	78.2	3.0	2,400	7.3	500	51	
R. Fk. Beaver Cr. 1/4 mi. above Garrett, Ky.	BsLBRf	110.7	Oct. 30		8.5	9.7	82.6	0.8	43	7.2	35	37	
"	"	"	Nov. 1		7.5	10.4	86.6	0.3	93	7.3	32	56	
R. Fk. Beaver Creek, lower edge of Garrett, Ky.	BsLBRf	110	Oct. 30		9.0	9.6	82.5	2.0	1,100	7.3	36	54	
"	"	"	Nov. 1		8.0	9.9	83.7	1.[illegible]	460	7.3	40	87	
Beaver Cr. 1/4 mile above Martin, Ky.	BsLB	96.8	Oct. 30		12.0	8.4	77.7	2.2	43	7.4	24	77	
"	"	"	Nov. 1		10.0	8.8	77.4	0.9	23	7.3	18	69	
Beaver Creek, lower edge of Martin, Ky.	BsLB	96	Oct. 30		11.5	8.2	75.0	2.8	150	7.7	15	114	
"	"	"	Nov. 1		9.5	8.5	74.3	2.5	1,100	7.3	22	81	
Beaver Creek, at mouth Allen, Ky.	BsLB	92.2	Oct. 30		11.5	9.0	82.4	1.3	240	7.7	14	160	
"	"	"	Nov. 1		11.0	9.4	85.1	1.7	240	7.4	17	95	
Levisa Fork, water plant Prestonsburg, Ky.	BsL	83	Nov. 21		8.5	11.0	94.1		240	7.1	14	87	
"	"	"	" 24		7.0	10.8	88.7	1.6	4	7.2	17	88	
"	"	"	" 28		5.0	12.4	97.0	2.3	4	7.4	15	86	
"	"	"	Dec. 1		5.5	12.8	101.0	2.0	43	7.2	19	80	

TABLE Bs-7 BIG SANDY RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth		Date 1939	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliform M.P.N. Per ml.	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Levisa Fk. below all sewage, Prestonsburg, Ky	BsL	82	Nov. 21		8.5	10.5	89.2		1,100	7.0	17	88	156
"	"	"	" 24		7.0	10.6	87.2	1.6	150	7.1	20	86	
"	"	"	" 28		3.0	12.6	93.3	2.2	23	7.3	12	84	
"	"	"	Dec. 1		6.0	9.9	79.0	7.7	93	7.0	27	91	
John Creek, at mouth, Auxier, Ky.	BsLJ	74	Nov. 21		8.0	10.2	85.8			7.2	7	189	143
"	"	"	" 24		6.0	11.3	90.5	0.8	23	7.4	14	127	
"	"	"	" 28		0.5	13.3	92.1	0.9	2	7.4	5	101	
"	"	"	" 29		2.0				4				
Miller Creek, at mouth Van Lear, Ky.	BsLM	68.9	Nov. 21		8.0	9.5	79.9		15	7.4	13	121	
"	"	"	" 24		6.0	10.6	84.9	0.3	24	7.7	11	218	
"	"	"	" 28		0.5	12.7	87.8	1.0	4	7.7	13	202	
Levisa Fk. 1½ miles below Van Lear, Ky.	BsL	68	Nov. 22		7.0	10.5	86.4	2.0	4	7.3	12	87	
"	"	"	" 29		3.5	12.0	90.3	1.9	**	7.3	11	89	
Levisa Fork, above Paintsville, Ky.	BsL	67.5	Nov. 28		4.0	11.3	86.3	1.3	6	7.4	7	84	
"	"	"	" 30		4.0	11.9	90.3	1.1	9	7.3	8	65	
"	"	"	Dec. 1		6.0	12.0	96.1	1.8	2	7.3	7	85	
Levisa Fk. above water plant, Paintsville, Ky.	BsL	67.2	Nov. 21		8.5	10.6	90.7		2	7.2	8	89	153
"	"	"	" 22		7.5	10.4	86.6	2.0	2	7.3	8	66	
Paint Creek, above Paintsville, Ky.	BsLP	67.5	Nov. 29		4.0	10.7	81.5	1.2	46	7.1	17	90	
Paint Creek, upper edge of Paintsville, Ky.	BsLP	67	Nov. 20		9.0	9.3	80.2		4	7.0	25	[illegible]	202
"	"	"	" 24		6.0	8.0	63.9	1.1	4	7.0	25	93	
"	"	"	" 27		5.5	10.0	78.7	0.8	9	7.2	20	83	
"	"	"	Dec. 1		5.0	10.7	83.7	0.8	4	7.1	22	86	
Paint Cr. 100yds. above mouth, Paintsville, Ky.	BsLP	66.5	Nov. 20		9.0	2.3	20.1		4,600	7.0	37	102	254
Paint Creek, at mouth Paintsville, Ky.	BsLP	66	Nov. 24		7.0	1.7	14.3	10.9	2,300	7.0	30	104	
"	"	"	" 27		5.0	5.2	40.3	7.8	4,600	7.0	25	103	
"	"	"	" 29		1.0	6.7	47.4	15.7	4,600	7.1	21	101	
"	"	"	Dec. 1		4.5	6.6	50.7	17.0	930	7.0	32	99	
Muddy Branch, at mouth Paintsville, Ky.	BsLM	65	Nov. 22		7.0	11.0	90.1	1.6	1	4.8	7		194
"	"	"	" 29		0.5	13.2	91.3	2.0	2	4.8	6		
"	"	"	" 30		5.0	11.6	90.5	1.2	2	4.8	6		
Levisa Fork, below mouth Paint Cr., Paintsville	BsL	64.5	Nov. 21		6.5	10.1	86.1		460	7.2	13	89	158
"	"	"	" 28		4.0	11.0	89.7	1.7	240	7.3	12	86	
"	"	"	Dec. 1		5.5	11.1	87.9	3.7	1,100	7.3	18	87	
Levisa Fork, below Paintsville, Ky.	BsL	64	Nov. 22		8.0	9.8	82.5	2.2	93	7.2	10	87	
"	"	"	" 30		4.5	11.5	88.8	2.6	240	7.3	13	89	

TABLE Bs-7 BIG SANDY RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth		Date 1939	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
						p.p.m.	% Sat.						
Shannon Branch 2 mi. below mouth Georges Cr.	BsLS	40	Nov. 29		2.5	12.9	94.5	1.3	**	7.3	8	90	
Levisa Fk. 2½ miles below Georges Cr.	BsL	39.5	Nov. 22		7.5	10.4	86.5	2.0	4	7.5	10	106	
Levisa Fk. Station 8.2 Dam No. 1	BsL	35	June 23		23.0	6.8	78.3	1.5	240		170	30	
Levisa Fork, Sta. 2.7 Walbridge Hwy. Bridge	BsL	30	Aug. 4		26.5	6.9	84.7	0.7	46				
"	"	"	" 18		26.0	6.5	79.1	0.9	240				
"	"	"	Sept. 1		23.5	6.3	73.0	1.2	23	7.7	18	54	
"	"	"	" 15		25.0	7.0	83.5	0.4	4				
"	"	"	" 29		22.5	7.8	89.1	0.5	1				
"	"	"	Oct. 13		17.5	6.7	69.3	1.0	4				
"	"	"	" 27		18.0	8.2	85.8	1.0	**				
"	"	"	Nov. 10		7.5	10.4	86.9	0.8	2				
"	"	"	" 24		8.5	9.0	76.9	0.5	**				
"	"	"	Dec. 8		5.5	10.8	85.4	0.6	1				
"	"	"	Dec. 29		2.5	13.3	97.5	1.3	1				
"	"	"	1940 Feb. 9		2.5	13.2	96.9	0.6	2				
"	"	"	" 13		6.5	11.7	94.8	0.9	46				
"	"	"	Mar. 8		5.0	11.7	91.5	0.5	39				
"	"	"	Apr. 5		14.0	9.2	88.8	0.5	93				
Levisa Fk. Sta. 0.1 Fort Gay	BsL	27.6	July 7		25.0	5.8	69.2	2.0	460	7.3	900	21	
"	"	"	" 21		23.0	6.6	75.5	1.7	240	7.1	1,000	25	
"	"	"	Aug. 4		27.0	6.9	85.0	0.6	110	7.5	85	40	
"	"	"	" 18		27.0	6.6	81.5	1.1	43	7.6	200	55	
"	"	"	Sept. 1		25.0	7.3	86.6	0.8	93				
"	"	"	" 15		25.0	7.0	83.1	0.7	4	7.6	7	65	
"	"	"	" 29		23.5	7.8	90.8	1.5	11	7.6	5	79	
"	"	"	Oct. 13		17.5	7.9	82.1	0.9	43	7.7	12	81	
"	"	"	" 27		18.0	8.2	86.2	0.8	43	7.6	12	90	
"	"	"	Nov. 10		8.0	9.6	80.4	1.0	23	7.5	18	84	
"	"	"	Nov. 24		7.5	9.7	80.8	0.8	2	7.5	8	83	
"	"	"	Dec. 8		5.0	11.4	89.2	0.7	24	7.4	9	107	
"	"	"	" 29		1.5	13.5	96.1	1.1	2	7.2	7	70	
"	"	"	1940 Feb. 9		2.0	13.4	96.5	0.8	2	6.8	16	45	
"	"	"	" 13		5.5	11.7	92.8	1.6	110	7.6	190	28	
"	"	"	Mar. 8		4.5	11.8	91.2	0.6	21	6.9	52	21	
"	"	"	Apr. 5		13.0	9.2	86.9	0.7	93	6.6	95	20	
Big Sandy River Sta. 26.6, below Louisa, Ky.	Bs	26.6	June 23	3,930	27.0	6.4	79.4	2.1	460		300	32	
"	"	"	July 7	10,200	25.5	5.9	71.1	1.9		7.1	1,100	21	
"	"	"	" 21	4,300	23.0	6.9	79.0	1.6	460				
"	"	"	Aug. 4	1,590	27.0	7.1	88.0	0.6	24	7.4	50	41	
"	"	"	" 18	1,300	26.5	6.5	79.3	2.2	93	7.6	300	61	
"	"	"	Sept. 1	275	25.5	7.7	92.8	1.1	240	7.8	7	55	
"	"	"	" 15	185	25.5	7.4	89.0	1.1	75	7.7	6	68	
"	"	"	" 29	95	23.0	8.1	93.1	0.5	240	8.0	12	78	

TABLE Bs-7 BIG SANDY RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth		Date 1939	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Big Sandy River, Sta. 26.6 below Louisa, Ky.	Bs	26.6	Oct. 13	102	19.5	8.2	88.6	0.8	4	8.0	7	102	
"	"	"	" 27	72	19.0	8.5	91.1	1.3		7.9	10	91	
"	"	"	Nov. 10	102	7.0	10.0	82.4	0.9	36	7.6	11	91	
"	"	"	" 24	87	7.5	9.9	82.3	1.0	46	7.6	8	90	
"	"	"	Dec. 8	87	5.0	11.7	91.1	0.8	93	7.3	9	115	
"	"	"	" 29	250	2.0	12.9	93.4	1.9	4	7.4	8	71	
"	"	"	1940 Feb. 13	2,840	6.0	11.4	91.2	1.7	24	7.6	130	46	
"	"	"	Mar. 8	3,640	4.0	11.8	90.0	0.6	39	6.9	45	23	
"	"	"	Apr. 5	4,260	13.0	9.2	86.6	0.6	43	6.6	95	22	
Big Sandy River Sta. 0.3 Dam #1	Bs	0.3	June 1	1,240	27.0	7.5	93.2	2.9	43		14	39	
"	"	"	" 5	2,520	27.5	7.9	98.5	2.5	23		18	43	
"	"	"	" 7	2,530	26.5	6.2	75.8	1.3	43		230	43	
"	"	"	" 9	2,110	27.0	6.5	80.2	1.2	23		73	45	
"	"	"	" 13	2,830	25.0	6.8	80.9	2.0	240		183	34	
"	"	"	" 15	1,760	25.0	6.9	81.9	1.1	93		185	41	
"	"	"	June 19	1,310	27.0	6.4	79.4	1.0	75		90	39	
"	"	"	" 21	5,230	27.0	7.6	94.1	1.2	240		36	42	
"	"	"	" 23	4,210	27.0	6.6	82.3	0.8	240		240	33	
"	"	"	" 27	1,160	28.0	6.3	79.5	1.0	93	7.3	100	37	
"	"	"	" 29	1,500	28.5	6.2	79.1	1.1	23	7.3	65	43	
"	"	"	July 5	9,300	27.5	7.3	91.5	1.2		7.8	40	43	
"	"	"	" 7	10800	25.0	4.6	55.0	3.4		7.0	1,250	19	
"	"	"	" 11	3,330	26.5	6.6	81.6	1.1	91	7.2	240	32	
"	"	"	" 13	2,180	27.5	6.8	85.6		150	7.5	60	33	
"	"	"	" 17	2,000	26.0	9.1	110.6	2.0	23	7.7	25	40	
"	"	"	" 19	1,760	26.0	8.5	103.2	1.7	4	7.5	12	38	
"	"	"	" 21	4,910	24.0	6.6	77.1	1.3	24	7.2	600	26	
"	"	"	" 25	2,850	26.5	7.1	87.2	0.6	46	7.2	60	39	
"	"	"	" 27	3,190	28.0	6.8	86.1	1.0	46	7.2	125	38	
"	"	"	" 31	4,330	26.0	6.7	82.0	0.9	75	7.5	250	32	
"	"	"	Aug. 2	3,080	26.5	7.4	91.3	0.6	43	7.3	75	31	
"	"	"	Aug. 4	1,710	27.0	7.0	96.7	1.6	93	7.5	80	37	
"	"	"	" 8	680	27.0	8.1	99.9	1.9	9	7.7	28	47	
"	"	"	" 10	350	27.0	8.1	100.0	2.1	9	7.4	27	49	
"	"	"	" 14	610	28.0	6.8	85.8	1.5	9	7.7	75	57	
"	"	"	" 16	820	28.0	7.2	91.3	1.1	24	7.7	30	69	
"	"	"	" 18	1,370	29.0	7.2	92.1	1.0	9	7.7	23	74	
"	"	"	" 22	1,010	26.0	7.4	90.2	1.4	9	7.6	34	54	
"	"	"	" 24	250	26.0	8.9	108.0	1.7	8	7.7	10	56	
"	"	"	" 28	325	26.0	7.0	85.2	1.2	24	7.6	18	68	
"	"	"	" 30	340	25.5	6.1	74.0	1.8	9	7.5	10	60	
"	"	"	Sept. 1	300	26.5	7.7	94.7	1.6	240	7.6	14	61	
"	"	"	" 6	233	25.5	4.9	58.4	1.1	460	7.1	55	52	
"	"	"	" 8	262	26.5	6.0	73.2	1.4	91	7.7	27	64	
"	"	"	" 12	230	26.0	6.4	78.1	1.3	430	7.7	10	67	
"	"	"	" 14	198	27.5	6.2	77.3	1.2	91	7.6	10	74	
"	"	"	" 18	134	25.5	6.1	72.9	1.0	230	7.6	7	75	

TABLE Bs-7 BIG SANDY RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1939	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Big Sandy River Sta. 0.3 Dam #1	Bs 0.3	Sept. 20	197	25.5	5.9	70.8	1.3	30	7.4	10	73	
" "	" "	" 22	134	24.0	5.2	60.7	1.1	75	7.5	12	79	
" "	" "	" 26	134	23.0	6.0	69.4	1.2	75	7.6	10	80	
" "	" "	" 28	134	26.0	6.2	75.0	1.1	240	7.6	5	81	
" "	" "	Oct. 2	110	21.5	6.1	68.7	1.0	36	7.6	12	81	
" "	" "	" 4	104	22.0	6.5	73.3	1.0	91	7.7	8	81	
" "	" "	" 6	110	21.0	6.1	67.7	1.0	23	7.8	12	86	
" "	" "	" 10	110	24.5	7.1	83.7	1.7	110	7.8	7	88	
" "	" "	" 12	109	24.5	6.6	78.3	1.0	23	7.8	7	89	
" "	" "	" 16	93	19.0	6.7	71.3	1.0	93	7.6	8	93	
" "	" "	" 18	93	17.0	6.6	68.2	1.0	93	7.7	8	93	
" "	" "	" 20	93	19.0	7.1	75.7	1.2	43	7.7	8	96	
" "	" "	" 24	93	18.5	6.2	65.8	1.3	23	7.5	5	100	
" "	" "	" 26	77	20.0	6.4	69.8	1.4	240	7.7	97	15	
" "	" "	" 30	130	17.5	5.0	52.1	1.5	240	7.3	21	94	
" "	" "	Nov. 1	84	17.5	5.7	59.5	1.4	43	7.3	17	96	
" "	" "	Nov. 3	118	11.5	5.9	54.2	1.4	43	7.3	13	97	
" "	" "	" 7	112	13.5	6.4	60.9	1.6	93	7.2	10	104	
" "	" "	" 9	111	14.0	6.5	62.6	1.8	43	7.3	8	98	
" "	" "	" 13	95	11.5	5.3	48.4	2.7	4	7.2	11	95	
" "	" "	" 15	95	12.5	5.7	53.0	2.4	46	7.3	8	90	
" "	" "	" 17	95	14.0	5.7	55.0	3.6	24	7.2	12	85	
" "	" "	" 27	79	10.0	6.6	58.0	2.1	93	7.3	8	103	
" "	" "	" 29	95	9.0	7.4	64.0	2.0	93	7.4	9	96	
" "	" "	Dec. 1	79	10.0	8.1	71.6	1.8	23	7.3	11	99	
" "	" "	" 5	95	10.0	7.8	68.8	2.1	43	7.3	7	103	
" "	" "	" 7	95	10.5	7.7	68.9	2.4	240	7.3	8	101	
" "	" "	" 11	95	9.0	6.9	59.9	2.8	43	7.2	7	100	
" "	" "	" 13	95	10.5	7.2	63.9	2.5	9	7.4	6	98	
" "	" "	" 15	79	10.5	7.3	64.7	2.4	93	7.1	6	99	
" "	" "	" 19	103	10.5	7.5	66.9	1.7	23	7.4	7	99	
" "	" "	" 21	117	10.0	7.8	69.1	1.8	43	7.5	8	101	
" "	" "	Dec. 26	222	6.0	8.0	63.8	1.6	43	7.7	5	99	
" "	" "	" 28	277	7.0	8.7	71.6	1.5	43	7.4	6	98	
" "	" "	1940 Jan. 2	483	0.5	13.3	92.2	1.3	4	7.2	8	83	
" "	" "	" 12	250	3.0	10.3	75.8	0.9	110	6.9	25	86	
" "	" "	" 16	884	0.5	12.9	89.3	1.2	23	6.9	80	49	
" "	" "	Feb. 15	4,470	2.5	12.4	90.5	1.5	43	7.0	150	23	
" "	" "	" 19	6,400	2.5	12.4	90.9	1.8	43	6.9	250	25	
" "	" "	" 21	5,900	5.0	11.7	91.5	1.0	23	6.9	120	19	
" "	" "	" 23	5,240	3.5	11.9	89.7	0.9	15	6.9	55	19	
" "	" "	" 27	2,000	3.5	12.6	94.4	1.5	150	7.1	160	28	
" "	" "	" 29	3,350	3.5	12.3	92.3	1.1	23	7.0	100	25	
" "	" "	Mar. 4	10300	6.5	10.6	90.2	1.6	43	7.0	350	25	
" "	" "	" 6	6,750	7.5	10.5	87.4	0.8	15	7.3	170	20	
" "	" "	" 8	4,200	6.5	11.1	90.1	1.1	43	6.8	52	21	
" "	" "	" 12	1,830	4.5	12.2	94.1	0.7	7	6.9	34	24	
" "	" "	" 14	1,720	5.0	12.6	98.3	0.7	460	6.8	21	27	

TABLE Bs-7 BIG SANDY RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth		Date 1940		Average Discharge c. f. s.	Temp. °C	Dissolved Oxygen		5 Day B. O. D. p. p. m.	Coliforms M. P. N. Per ml	pH	Turbidity p. p. m.	Alkalinity p. p. m.	Hardness p. p. m.
							p. p. m.	% Sat.						
Big Sandy River, Sta. 0.3, Dam #1	Bs	0.3	Mar.	18	4,730	7.5	11.5	96.0	1.0	9	6.8	45	30	
" "	"	"	"	20	4,580	9.0	10.8	93.3	0.9	75	7.1	35	22	
" "	"	"	"	22	5,630	8.5	10.8	92.5	0.6	93	6.8	32	23	
" "	"	"	"	26	1,960	4.0	12.4	94.5	1.0	9	6.7	20	25	
" "	"	"	"	28	1,620	7.0	11.9	97.9	0.5	9	6.6	10	27	
" "	"	"	Apr.	1	15730	9.5	9.7	85.0	1.5	110	6.8	260	19	
" "	"	"	"	3	9,190	12.5	9.3	86.8	1.1	43	7.0	21	65	
" "	"	"	"	5	4,740	13.0	9.3	88.0	0.7	75	6.5	37	20	
" "	"	"	"	9	3,720	11.5	10.8	95.8	0.6	23	6.7	25	24	
" "	"	"	"	11	3,620	11.5	10.1	92.3	0.6	43	6.7	16	25	

* Seeded and neutralized.

** Less than one

GUYANDOT RIVER BASIN

Final Report to the Ohio River Committee

Ohio River Pollution Survey

U. S. Public Health Service
Cincinnati, Ohio
1942

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GUYANDOT RIVER BASIN

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GUYANDOT RIVER BASIN*

Syllabus and Conclusions

Syllabus

The Guyandot Basin, comprising 1,670 square miles in the mountains of southern West Virginia, is an important coal mining area and is similar to the Big Sandy River Basin to the west. Only about five percent of the total population of 148,000 is urban. Sanitary conditions are poor. Pollution is uncontrolled, causes local damage and affects public water supplies. Acid mine drainage and coal washery wastes damage tributary streams. Techniques are available for abatement of the pollution but the needs of the people in other directions limit present justifiable correction to partial treatment.

Conclusions

(1) There are 17 public water supplies taken from surface sources, of which 5 are from streams receiving sewage from one or more communities above the water intake. At the largest of these, Logan, local sewage affects the water supply.

(2) Sewage from a population of 23,900 is discharged without treatment. The Guyandot River is not heavily polluted. The largest sources of pollution are at Logan and Mullens. There are no organic industrial wastes of consequence although coal washery wastes and acid mine drainage damage a few tributary streams. About half of the acid mine drainage load has been removed by sealing abandoned mines.

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* For maps of this Basin, see Big Sandy River Basin.

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(3) Laboratory studies show that the effects of pollution are primarily local and that the Guyandot River at Logan and above presents the major pollution problem. The streams recover rather quickly from the effects of pollution and are in relatively good condition at short distances below the sources of pollution.

(4) Low-flow augmentation by flood-control reservoirs would not have any appreciable value for pollution abatement.

(5) Primary treatment of all sewage would be sufficient to maintain good stream conditions at most places. At some communities, where stream flows approach zero, secondary treatment would be required to prevent local nuisances. Considering the present financial condition of the towns, justification for the expenditure beyond partial treatment is questionable.

(6) A summary of cost estimates of remedial measures from Table Gy-1 follows:

Treatment	Capital Cost	Annual Charges
Existing	0	0
Suggested additional	$530,000	$45,000

Estimated additional costs, over existing charges, of programs involving uniform treatment throughout the basin are:

Primary, all places	$530,000	$45,000
Secondary, all places	730,000	70,000

Table Gy-1 Guyandot River Basin - Estimated Cost of Existing and Suggested Minimum Corrective Measures for Sewage and Industrial Wastes, with Comparative Costs for Primary and Secondary Treatment.

	Number of Plants Prim.Sec.	Population Connected to Sewers	Capital Investment (Dollars)	Annual Charges (Dollars)		
				Amort. & Interest	Operation & Main.	Total
Existing Sewage Treatment	-	-	0	0	0	0
Suggested Minimum Correction						
Sewage Treatment Plants	13 0	19,700	300,000	20,000	15,000	35,000
Required Interceptors		-	230,000	10,000	-	10,000
Independent Industrial Waste Correction	-	-	-	-	-	-
Total			530,000	30,000	15,000	45,000
Comparative Cost						
Primary Treatment All Waste			530,000	30,000	15,000	45,000
Secondary Treatment All Waste			730,000	47,000	23,000	70,000
As Suggested			530,000	30,000	15,000	45,000

Description

The Guyandot River drains 1,670 square miles of mountainous country in southern West Virginia and joins the Ohio River at Huntington, W.Va. Its only important tributary is the Mud River which drains 358 square miles and joins the Guyandot seven miles above its mouth. With the development of coal mining the population of the basin has increased as shown below:

	1910	1920	1930	1940
Rural	61,630	89,900	117,233	140,065
Urban	-	2,998	4,396	8,192
Total	61,630	92,898	121,629	148,257

The only towns of urban size are Logan (population 5,166) and Mullens (population 3,026). Much of the rural population is in mining camps which are concentrated in the vicinity of Logan and in the extreme southeastern part of the basin.

Water Uses - The Guyandot is not navigable except near its mouth where it is affected by backwater from the Ohio. There are no hydroelectric power developments nor are there any proposed. No flood-control projects have been built but a reservoir above Milton on Mud River has been considered by the U. S. Engineer Department in connection with the authorized program for Ohio River flood control. The Guyandot and some of its tributaries are considered fairly good bass fishing streams and are extensively used by local residents, but there are no developed recreation areas.

Presentation of Field Data

Figure Bs-1 shows the location and magnitude of each source of pollution of consequence in the basin. Figure Gy-2 shows similar data and, in addition, the location of water supply intakes below sources of pollution and laboratory data on coliform organisms, dissolved oxygen and B.O.D.

Public Water Supplies - Eighty-nine public water supplies in the basin serve 61,500 people. Only 17 of these are from surface sources and only five of the surface supplies come from streams subject to pollution. Table Gy-2 shows data on the surface supplies. The underground water is usually quite hard and is limited in quantity. A number of the communities use mine drainage as a source of water.

Sewerage - Table Gy-3 shows the sewered population at each of the more important sources of pollution in the basin. Less than half of the people served by water supplies are connected to sewers. None of the sewage is treated. In addition to this sewage, a considerable amount of polluting matter reaches the stream from insanitary privies overhanging the streams or on the stream banks. Garbage and other refuse is commonly dumped into the streams.

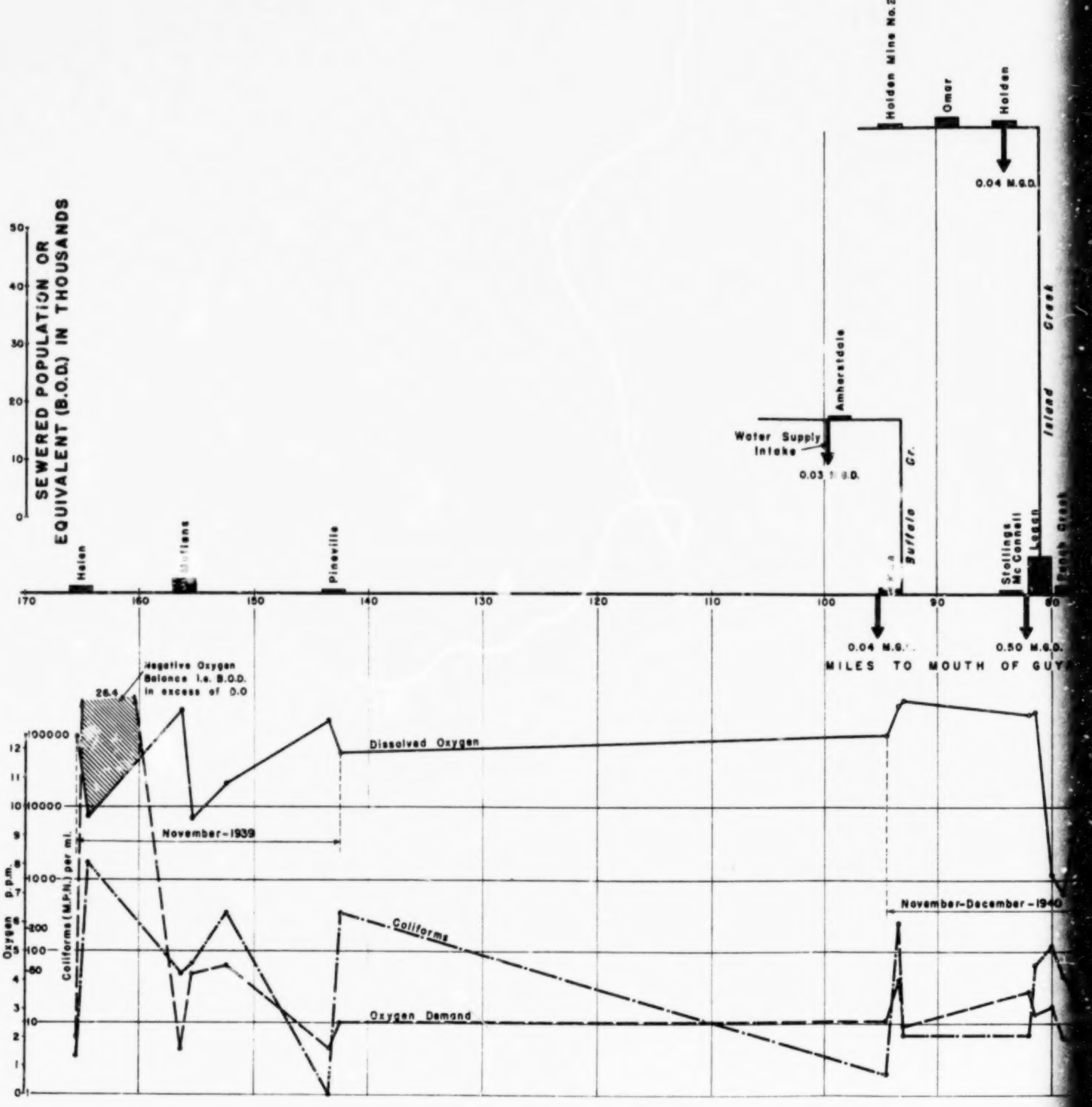
Industrial Wastes - The only industry in the basin discharging organic wastes is a small cannery at Milton. Most of the 25 coal washeries in the basin cause some pollution by the discharge of fine coal particles which make the streams turbid and blanket the bottom. The steam-electric power plant at Logan dumps ashes from about 900 tons of coal per day into the Guyandot River.

Acid Mine Drainage - causes damage to some of the tributary streams but has no great effect on the main stream. Island Creek receives most of the acid drainage. The original acid load has been reduced by about 46% by the mine sealing program formerly in operation in the area. Most of the remaining acid comes from active mines.

Table Gy-2 Guyandot River Basin - Surface Water Supplies

Supply	State	Source	Mile (1)	Treat-ment (2)	Pop. Served	Con-sumption M.G.D.
Supplies Below Community Sewer Outfalls						
Logan	W.Va.	Guyandot River	82	FD	9,000	0.50
Man	"	" "	93	FD	1,000	0.04
Milton	"	Mud River	24	FD	1,400	0.06
Monaville	"	Island Creek, Mill Creek	84	ILD	800	0.04
Amherstdale	"	Mine-Buffalo Cr.	99	D	700	0.03
Other Surface Supplies						
Whitman	W.Va.	Mine-Whitman Cr.	84	FD	1,500	0.06
Shegon	"	Well-Mud Fork	85	FD	600	0.04
Holden Mine #22	"	" Pine Creek	94	ILD	500	0.06
Omar (3)	"	" Little Creek	92	D	2,000	0.15
Barnabus (3)	"	" " "	92	D	200	0.02
Stirrat (3)	"	" " "	92	D	1,500	0.08
Slagle	"	Rum Creek-Well	94	D	700	0.03
Macbeth	"	Mine-Small stream	-	D	400	0.02
Earling	"	" " "	-	D	700	0.02
Amherstdale (Becco)	"	" " "	-	None	800	0.04
Covel	"	Small stream	-	(4)	300	0.01
Wacomah	"	" " -Mine	-	None	100	0.01
Total - Below Sewer Outfalls					12,900	0.67
Other					9,300	0.54
Total - Surface Water Supplies					22,200	1.21

(1) Miles above mouth of Guyandot River.
(2) F - Coagulated, settled, filtered, I - Iron removal, L - Lime-soda softened, D- Chlorinated.
(3) These three towns have separate systems and wells for use during summer. During the winter they are all served by supply from Little Creek above Stirrat.
(4) Filtered, no coagulants.


SEWERED POPULATION OR EQUIVALENT (B.O.D.) IN THOUSANDS
50
40
30
20
10
0
Helen
Mullens
Pineville
Water Supply Intake
0.03 M.G.D.
Amherstdale
Buffalo Cr.
Holden Mine No.22
Omar
Holden
0.04 M.G.D.
Island Creek
Stollings
McConnell
Logan
Peach Creek
170
160
150
140
130
120
110
100
90
80
0.04 M.G.D.
0.50 M.G.D.
MILES TO MOUTH OF GUYA
Negative Oxygen Balance i.e. B.O.D. in excess of D.O
26.4
Dissolved Oxygen
November-1939
November-December-1940
Coliforms
Oxygen Demand
Oxygen p.p.m.
Coliforms (M.P.N.) per ml.
100000
10000
1000
200
100
50
10
1
12
11
10
9
8
7
6
5
4
3
2
1
0

A

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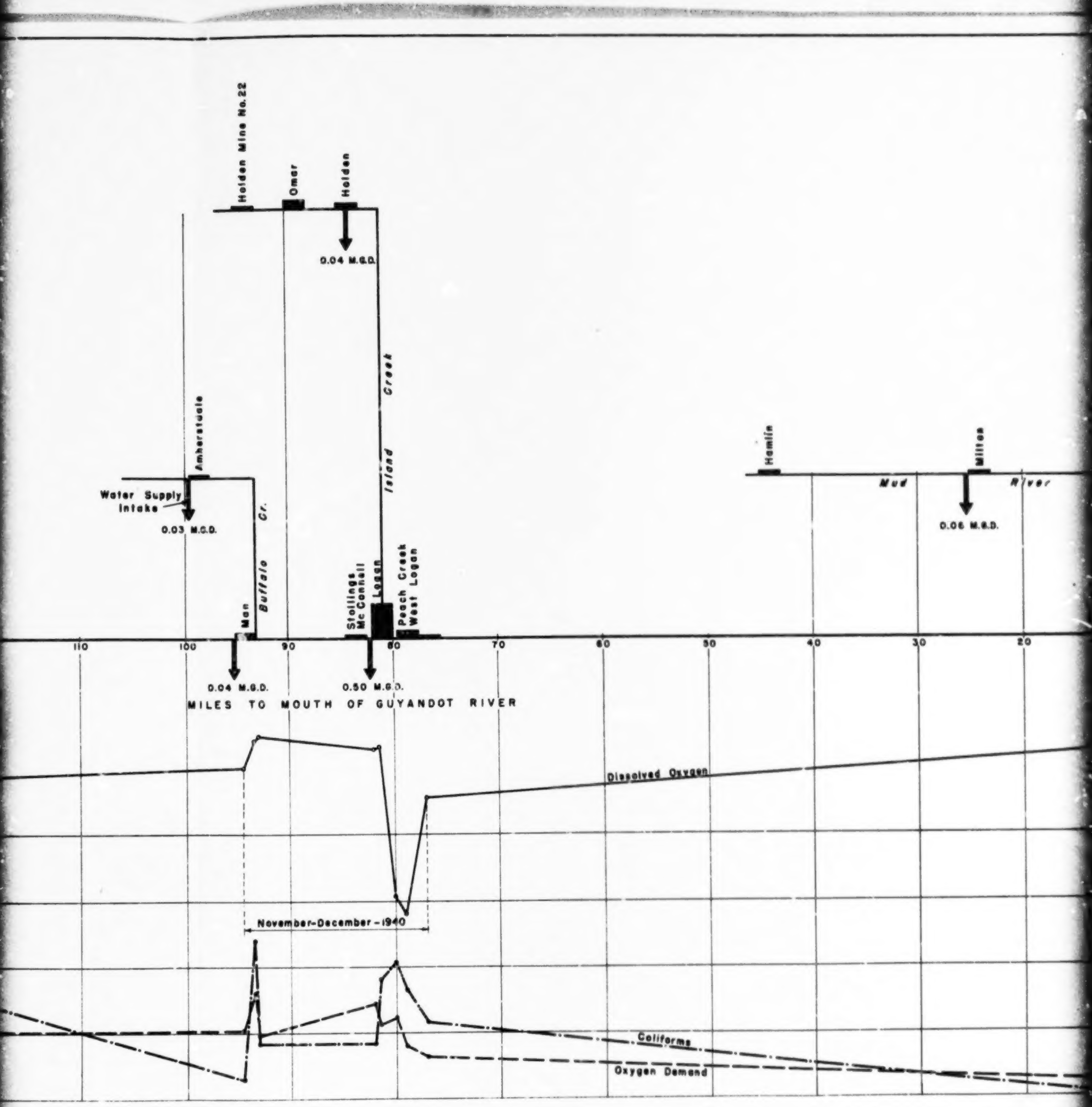
Holden Mine No. 22
Omar
Holden
0.04 M.G.D.
Island Creek
Amherstdale
Water Supply Intake
0.03 M.G.D.
Buffalo Cr.
Man
Stollings
Mc Connell
Logan
Peach Creek
West Logan
Hamlin
Milton
Mud River
0.06 M.G.D.
110
100
90
80
70
60
50
40
30
20
0.04 M.G.D.
0.50 M.G.D.
MILES TO MOUTH OF GUYANDOT RIVER
Dissolved Oxygen
November-December-1940
Coliforms
Oxygen Demand

②

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FIG. Gy-2

C

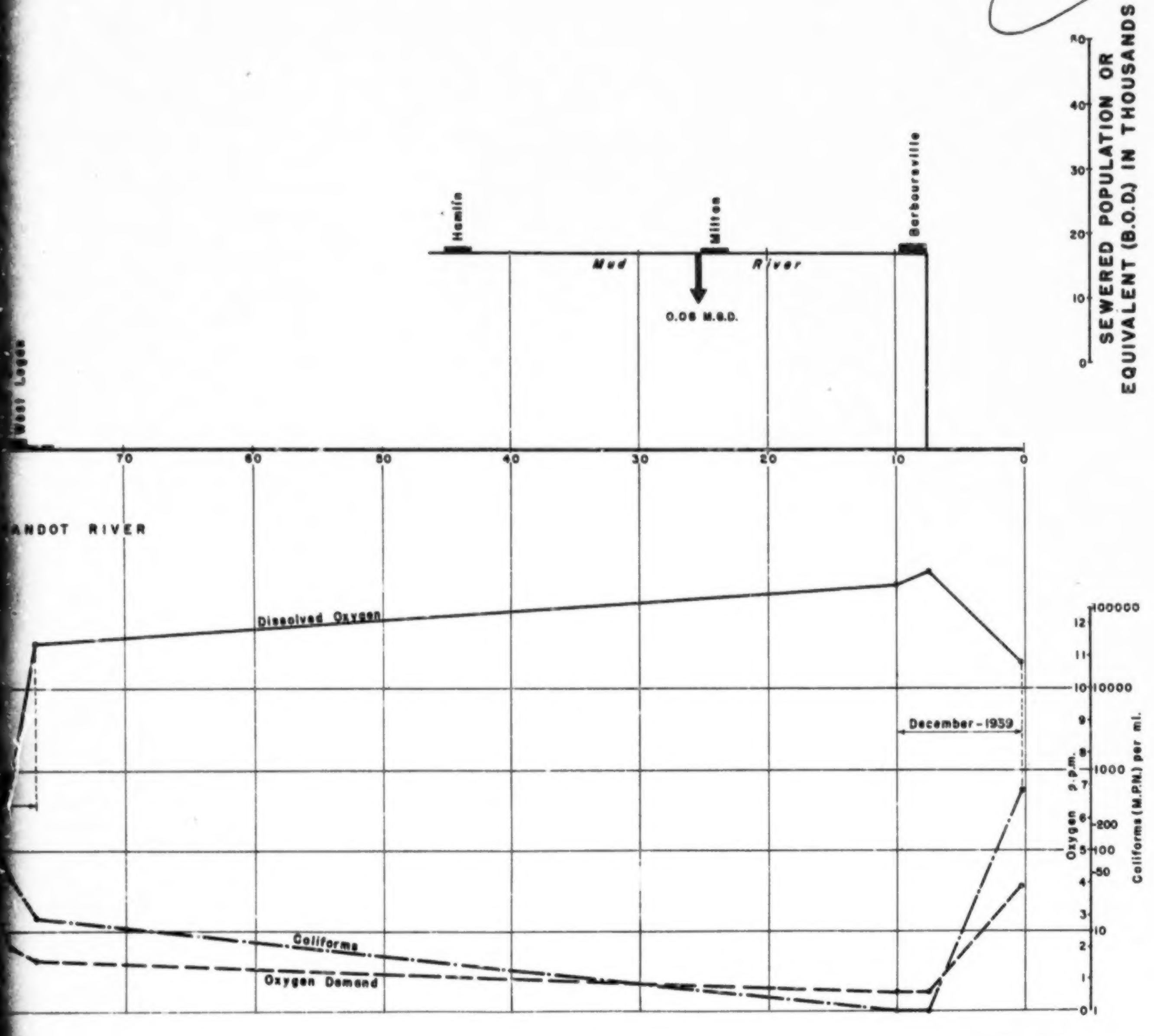

FIGURE - Gy 2

GUYANDOT RIVER

SOURCES OF POLLUTION
AND
SELECTED LABORATORY DATA

OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941

Table Gy-3 Guyandot River Basin - Sources of Significant Pollution Including Industrial Wastes, Expressed as Sewered Population Equivalent (B.O.D.)

Municipality	Receiving Stream	Miles Above Mouth of Guyandot R.	Population Connected to Sewers	Treatment	Sewered Population Equivalent (B.O.D.)	
					Untreated	Discharged
Merrill	Guyandot River	77	500	None	500	500
West Logan	" "	78	900	"	900	900
Peach Creek	" "-Peach Cr.	78	500	"	500	500
Logan (1)	" "-Island Cr.	81	5,900	"	5,900	5,900
Stollings-McConnell	" "	83	600	"	600	600
Man	" "-Buffalo Cr.	94	1,100	"	1,100	1,100
Pineville	" "	143	700	"	700	700
Mullens	" "-Slab Fork	156	2,300	"	2,300	2,300
Barboursville	Mud River	8	1,400	"	1,400	1,400
Milton	" "	24	600	"	800	800
Hamlin	" "	44	900	"	900	900
Holden	Copperas Mine Fork	84	1,000	"	1,000	1,000
Holden Mine #22	Pine Creek	94	500	"	500	500
Omar	Island Cr.-Pine Cr.	89	1,600	"	1,600	1,600
Helen	Winding Gulf Cr.- Berry Branch	165	1,200	"	1,200	1,200
21 smaller sources	-	-	4,200	"	4,200	4,200
Total			23,900	-	24,100	24,100

(1) Including some adjoining communities.

Presentation of Laboratory Data

A tabulated summary of the laboratory results is presented in Table Gy-7. Selected data are in Table Gy-5.

Laboratory observations in the Guyandot Basin were carried out largely by a mobile laboratory unit during November and December, 1939. Observations at the mouth were made from two to four times monthly during the 10-month period from June, 1939 to April, 1940 by the laboratory boat Kiski from Ashland. The Kiski also made observations at Barboursville and along the Mud River.

Figures Bs-3, Bs-4 and Bs-5 present graphically on spot symbol maps the results of the coliform, dissolved oxygen and oxygen demand determinations at the several sampling points. The results thus presented are averages of from one to three determinations from those points sampled during a period of less than one month and represent the most unfavorable monthly average where observations were made over a period of several months.

The Guyandot River above Logan presents the major pollution problem in the basin. Points below Logan and on the Mud River show little pollution except at the mouth where the results are affected by Huntington's sewage. The coliform and oxygen demand results are in good agreement as to the major sources of pollution - Helen, Mullens, Man, Omar, Holden and Logan being the more marked sources of pollution. The dissolved oxygen results presented a uniformly good picture.

The stream recovered sufficiently between one source of pollution and the next to produce relatively good conditions at those stations above town. Considerable coliform and oxygen demand reduction is apparent in these stretches despite the rather cool weather. Stream flows in general were low during the sampling period except in the area sampled from the Kiski.

Acid stream conditions were found along Island Creek and its tributary Copperas Mine Fork, pH values ranged from 4.5 to 5.2 and phenolphthalein acidities from about 20 to more than 200 p.p.m.

The laboratory results indicate that the effects of pollution on the Guyandot were primarily local under the low stream flow conditions existing at most stations during the time of this survey.

Biological Summary - The Guyandot is heavily polluted in the upper reaches by mine drainage, which renders that portion of the stream unsuitable for aquatic life. The plankton volume of less than 500 p.p.m. indicates that the entire stream is comparatively free from organic pollution.

Table Gy-5 Guyandot River Basin - Selected Laboratory Data - Main Stream and Tributaries.

River Location	Guyandot River		Guyandot River		Guyandot River		Guyandot above Logan
	above	below	above	below	above	below	
	Mullens		Pineville		Man		
River Miles Above: Mouth of Guyandot	156.5	155.5	143.5	142.5	94.5	93.5	82
Period - 1939							
Number of Samples	2	2	2	2	3	2	3
Flow in c.f.s.: Sampling Days	-	-	-	-	28	30	-
Water Temperature °C.	1.5	1.5	2.5	2.3	5.7	5.5	5.7
Coliforms per ml.	46	66	*	330	2	242	7
Dissolved oxygen ppm.	13	9.6	13.0	11.9	12.5	13.5	13.2
B.O.D.,5-day,p.p.m.	1.6	4.2	1.6	2.5	2.6	4.0	3.6

River Location	Guyandot River		Guyandot below Chapmans-ville	Guyandot below Barbours-ville	Winding Gulf Cr. below Helen	Island Creek below Omar	Copperas Mine Fk. below Holden
	Water Intake	below					
	Logan						
River Miles Above: Mouth of Guyandot	81.5	80	77	7.5	164.5	88.5	84
Period - 1939							
Number of Samples	3	3	2	1	2	2	2
Flow in c.f.s.: Sampling Days	-	37	37	-	-	-	-
Water Temperature °C.	5.0	10.3	6.5	1.5	3.5	5.8	7.3
Coliforms per ml.	64	118	13	0	1,750	1,670	41
Dissolved oxygen ppm.	13.3	7.7	11.4	13.6	9.6	8.4	8.9
B.O.D.,5-day,p.p.m.	2.8	3.1	1.6	0.6	26.4	21.2	13.2

* Less than one.

Hydrometric Data

Four stream gaging stations have been maintained in the Guyandot Basin at various times and two are currently operated. Table Gy-6 shows mean monthly flows during the summer months at these two stations for some of the dryer years of record.

Table Gy-6 Guyandot River Basin - Monthly Mean Summer Flows for Years in Which Lowest Summer Flows have Occurred.

River Location		Guyandot River Man	Guyandot River Branchland
River Miles Above: Mouth of Guyandot		94	54
Drain. Area Sq. Mi.		762	1,226
Period of Record		1929-40	1929-40
Year		1930	1930
June	c.f.s.	53.5	79.8
July	"	12.3	15.1
August	"	42.1	48.4
September	"	9.5	21.8
Year		1932	1932
June	"	923	1,460
July	"	956	2,090
August	"	186	245
September	"	31.4	42.4
Year		1939	1939
June	"	730	833
July	"	690	1,010
August	"	152	254
September	"	37	50.5

Low-flow Regulation - There are no flood-control or hydroelectric reservoirs in the basin at present. One reservoir has been authorized by the Congress as part of the comprehensive program for Ohio River flood control. This is on the Mud River above Milton and could be operated to increase the minimum flow below the reservoir by about 22 c.f.s. However, this additional flow would not reduce the degree of treatment required at downstream communities and the benefits would be largely intangible.

Discussion

The pollution problems of the Guyandot are primarily local ones. At most of the communities primary treatment of all sewage would be sufficient to maintain good oxygen conditions. At some of the towns on tributaries, stream flows become so low that secondary treatment probably would be needed to prevent local nuisances.

At Logan, sewage from the adjoining communities should be intercepted and treated with Logan's wastes. This is particularly desirable in the case of Stollings and McConnell whose sewage enters the Guyandot above Logan's water intake.

Because of the local nature of the pollution problems of the basin and the character of the communities it is suggested that partial treatment of all sewage be provided. Secondary treatment can be added as community finances permit.

Most of the coal washeries are equipped to recover the fine particles which now enter the streams at some of the plants. Those washeries not now equipped to recover the sludge should be so equipped and greater care in operation should be practiced to prevent the discharge of coal dust to the streams.

The estimated cost of the suggested pollution abatement program is summarized in Table Gy-1.

TABLE Gy-7 GUYANDOT RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1939	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
					p.p.m.	% Sat.						
Winding Gulf Creek Above Helen, W. Va.	GyWg 165.5	Nov. 13		4.5	12.8	98.8	1.7	46	7.9	5	173	
" "	" "	" 16		1.0	12.0	84.1	2.3	23	7.8	110	211	305
Winding Gulf Creek Below Helen, W. Va.	GyWg 164.5	Nov. 13		7.0	10.8	88.7	38.6	1,100	7.7	93	171	
" "	" "	" 16		0.0	8.5	57.9	14.2	2,400	7.9	15	189	295
Guyandot River - Above Mullens, W. Va.	Gy 156.5	Nov. 13		3.0	13.1	96.9	1.5		7.9	5	152	
" "	" "	" 16		0.0	13.5	92.6	1.7	46	7.6	12	148	195
Guyandot River - Below Mullens, W. Va.	Gy 155.5	Nov. 13		3.0	9.3	68.8	3.8	93	7.7	7	144	
" "	" "	" 16		0.0	10.0	68.2	4.6	39	7.6	3	134	215
Guyandot River - Below mouth Barkers Creek	Gy 152.5	Nov. 13		2.5	10.6	77.5	3.7	460	7.7	2	142	
" "	" "	" 16		0.5	11.0	76.1	5.3	240	7.8	8	128	175
Guyandot River - Above Pineville, W. Va.	Gy 143.5	Nov. 13		4.0	11.9	90.9	1.7	**	7.8	3	115	
" "	" "	" 16		1.0	14.0	98.7	1.6	**	7.7	3	106	401
Guyandot River - Below Pineville, W. Va.	Gy 142.5	Nov. 13		3.5	10.9	81.9	2.7	430	7.7	5	113	
" "	" "	" 16		1.0	12.8	90.2	2.4	230	7.6	0	125	117
Guyandot River - Above Man, W. Va.	Gy 94.5	Nov. 27		5.5	13.3	105.3	2.0	4	7.6	6	101	120
" "	" "	" 30		6.0	12.2	98.2	1.0	1	7.6	2	103	
" "	" "	Dec. 5		5.5	11.9	93.9	5.0	2	7.5	2	91	
Buffalo Creek - Above Man, W. Va.	GyB 94.5	Nov. 27	2	5.0	11.3	88.0	2.6	460	7.4	5	44	320
" "	" "	" 30	2	6.0	11.6	93.2	2.4	43	6.9	2	50	
" "	" "	Dec. 5	2	5.0	11.5	90.0	4.1	460	7.0	23	46	
Guyandot River - near sewer-below Man, W. Va.	Gy 93.5	Nov. 30	27	5.5	12.8	101.0	2.1	23	7.6	0	151	
" "	" "	Dec. 5	33	5.5	14.3	113.1	5.9	460	7.7	3	97	
Guyandot River - below Man, W. Va.	Gy 93	Nov. 27	30	6.5	13.7	111.1	2.4	7	7.9	2	95	120
Guyandot River - above Logan, W. Va.	Gy 82	Nov. 27		6.0	12.4	99.7	3.1	**	7.6	0	94	120
" "	" "	" 30		6.5	12.6	102.1		**	7.6	0	99	
" "	" "	Dec. 5		4.5	14.7	113.6	4.0	24	7.6	2	106	
Guyandot River Water Works Intake Above Logan, W. Va.	Gy 81.5	Nov. 27		6.0	13.1	104.6	3.0	93	7.7	12	89	180
" "	" "	" 30		4.5	12.6	97.4	1.6	75	7.6	3	95	
" "	" "	Dec. 5		4.5	14.3	109.9	3.8	23	7.5	2	97	
Island Creek-near sewer Omar, W. Va.	GyI 88.5	Nov. 30		8.0	6.7	56.2	19.9	2,400	7.1	18	116	
" "	" "	Dec. 5		3.5	10.0	75.6	22.5	930	7.1	87	105	
Island Creek - below Omar, W. Va.	GyI 88.0	Nov. 27		7.0	11.5	94.2	7.2	91	7.7	18	75	140

TABLE Gy-7 GUYANDOT RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1939	Average Discharge c.f.s.	Temp. °C.	Dissolved Oxygen		5 Day B.O.D. p.p.m.	Coliforms M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
					p.p.m.	% Sat.						
Island Creek - below Monitor, W. Va.	GyI 85.0	Nov. 28		1.5	11.8	84.2	2.3	36	6.8	8	26	580
" "	" "	Dec. 1		7.5	10.5	87.2	4.8	**	5.2	20		
" "	" "	" 6		0.0	11.0	88.3	1.1	4	6.4	1,800	21	
Copperas Mine Fork Below Holden, W. Va.	GyICm 84	Nov. 28		5.0	9.8	70.6	15.5	43	5.2	260		2,070
" "	" "	Dec. 1		9.5	7.9	69.3	11.0	39	4.8	395		
Island Creek At Mouth	GyI 81	Nov. 28	2	1.5	10.2	72.3	8.2	280	5.4	220		900
" "	" "	Dec. 1	3	8.0	8.0	67.6	9.5	230	4.5	165		
" "	" "	" 6	3	6.5	9.7	78.4	3.6	91	4.7	520		
Guyandot River - below Logan, W. Va.	Gy 80	Nov. 28	35	9.0	8.1	70.0	1.8	91	7.1	20	71	210
" "	" "	Dec. 1	34	13.0	6.9	65.5	2.3	240	7.1	8	75	
" "	" "	" 6	42	9.0	8.2	70.6	5.1	23	6.8	13	45	
Guyandot River - Bridge at Henlawson, W. Va.	Gy 79	Nov. 28	35	8.0	7.5	63.1	2.4	43	7.1	32	69	250
" "	" "	Dec. 1	34	11.5	6.6	60.3	1.6	43	7.2	2	85	
Guyandot River - below Chapmansville, W. Va.	Gy 77	Nov. 28	35	5.0	11.8	92.0	1.6	23	7.4	12	74	240
" "	" "	Dec. 1	34	8.0	11.0	92.4	1.6	3	7.4	5	60	
Guyandot River - 2 miles Abv. Barboursville, W.Va.	Gy 10	Dec. 15		1.5	13.2	94.2	0.6	0				
" "	" "	1940 Jan. 19		1.0	13.6	95.7	2.0	1				
" "	" "	Feb. 2		0.0	10.3	70.6	0.6	**	6.8	5		
" "	" "	" 16		1.0	13.5	95.1	0.6	11				
" "	" "	" 23		4.5	12.3	94.7	0.6					
" "	" "	Mar. 15		3.5	12.2	91.9	0.4	23				
" "	" "	" 28		9.0	11.6	100.3	0.2	0				
" "	" "	Apr. 4		16.5	9.3	94.3	0.4	15				
Mud River - 0.1 above Hamlin, W. Va. Rte. #3	GyM 45	Mar. 29		12.5	10.1	94.2	0.2	23				
" "	" "	Apr. 4		14.5	9.3	90.6	0.3	15				
Mud River - 1.1 mi. below Hamlin, W. Va.	GyM 43	Mar. 29		12.0	9.9	91.4	0.2	23	6.8	8	27	
" "	" "	Apr. 4		15.5	9.0	89.1	0.5	39	6.9	18	21	
Mud River - 0.1 mi. above Milton, W. Va. U. S. Rte. #60	GyM 25	Mar. 28		9.5	11.1	96.9	0.3	43				
" "	" "	Apr. 4		13.5	9.2	88.3	0.8	15				
Mud River - 1.1 mi. Below Milton, W. Va.	GyM 23	Mar. 28		9.0	11.1	95.6	0.5	9	6.7	8	30	
" "	" "	Apr. 4		14.0	9.2	88.3	1.0	43	6.8	33	25	
Guyandot R.-Below Corp. Barboursville, W. Va.	Gy 7.5	1939 Dec. 15		1.5	13.6	96.7	0.6	0	7.0	5	60	
" "	" "	1940 Jan. 19		1.0	13.7	96.3	2.4	9	6.9	12	39	
" "	" "	Feb. 2		0.5	10.4	72.4	0.7	2	6.8	5	44	
" "	" "	" 16		1.0	13.3	93.7	0.9	110	6.6	60	19	

TABLE Gy-7 GUYANDOT RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliform M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Guyandot River Corp. limit below Barboursville, W. Va.	Gy 7.5	Feb. 23		4.0	12.3	93.6	1.1	9	6.7	70	15	
" "	" "	Mar. 15		3.5	12.2	92.0	0.8	9	6.6	24	20	
" "	" "	" 28		9.0	11.7	101.0	0.3	4	6.6	6	18	
" "	" "	Apr. 4		15.5	9.5	94.1	0.4	24	6.9	9	15	
Guyandot River - Cabell County Highway Bridge	Gy 0.1	1939 June 23	420	26.5	6.8	84.0	1.3	240	7.2	110	23	
" "	" "	" 29	1,600	25.0	6.7	79.9	0.8	460		700	16	
" "	" "	July 7	3,475	25.5	6.4	77.1	1.8	11,000	7.2	600	19	
" "	" "	" 13	690	25.5	7.1	85.6	0.4	240	7.5	150	18	
" "	" "	" 21	2,247	23.0	7.6	87.3	1.4	460	7.2	380	30	
" "	" "	" 27	931	27.0	7.2	89.0	0.9	93	7.2	15	26	
" "	" "	Aug. 4	674	25.5	6.8	81.8	1.1	460	7.4	100	26	
" "	" "	" 10	349	25.5	6.8	81.3	0.9	240	7.3	28	32	
" "	" "	" 18	515	26.5	6.1	74.8	1.2	390	7.3	210	44	
" "	" "	" 24	182	25.5	6.8	81.9	1.3	430	7.5	22	42	
" "	" "	Sept. 1	96	24.0	7.4	86.2	2.2	430	7.2	20	46	
" "	" "	" 6	124	23.5	6.0	69.8	1.2	4,600	7.3	20	49	
" "	" "	" 14	68	24.5	4.1	48.5	2.9	11,000	7.4	10	60	
" "	" "	" 20	53	23.0	6.9	79.4	1.4	2,400	6.7	5	44	
" "	" "	" 28	47	23.0	0.1	0.9	4.3	4,600	7.5	22	62	
" "	" "	Oct. 6	58	19.0	6.4	68.2	2.1	2,400	7.6	18	53	
" "	" "	" 12	52	20.0	4.5	49.1	1.7	930	7.5	8	52	
" "	" "	" 20	39	16.5	5.8	59.1	4.4	4,600	7.5	22	45	
" "	" "	" 24	33	15.0	4.5	44.3	7.6	4,300	7.2	17	42	
" "	" "	Nov. 3	50	10.0	8.4	73.8	4.5	930	7.2	23	49	
" "	" "	" 9	52	9.0	10.7	92.2	1.4	91	7.1	6	31	
" "	" "	" 17	47	9.0	9.8	84.7	17.0	11,000	6.9	17	49	
" "	" "	" 27	60	7.0	9.2	75.3	6.6	11,000	7.2	24	63	
" "	" "	Dec. 5	83	5.5	10.0	79.1	5.2	1,500	7.2	12	59	
" "	" "	" 15	85	4.5	10.3	79.3	5.8	91	7.0	8	59	
" "	" "	" 21	117	6,5	10.3	83.5	3.0	150	7.4	9	64	
" "	" "	Dec. 28	144	1.0	12.8	89.6	1.8	460	7.2	9	55	
" "	" "	1940 Feb. 21	4,347	5.0	11.9	93.1	0.8	11	6.9	90	17	
" "	" "	" 27	3,390	3.0	12.6	93.8	1.5	460	7.0	42	16	
" "	" "	Mar. 8	2,200	5.0	11.6	91.0	0.6	23	6.9	25	19	
" "	" "	" 12	924	5.0	12.3	96.2	1.5	21	6.9	6	17	
" "	" "	" 20	1,860	9.0	11.1	96.0	0.8	75	7.1	80	21	
" "	" "	" 28	756	7.0	11.7	96.0	0.4	15	6.5	4	19	
" "	" "	Apr. 5	3,534	13.0	9.3	87.8	0.6	93	6.5	15	16	
" "	" "	" 11	2,323	11.5	10.2	92.8	0.7	93	6.6	20	17	

** Less than one.